THE DENTAL PRACTITIONER

AND DENTAL RECORD

Including the Transactions of the British Society for the Study of Orthodontics, and the official reports of the British Society of Periodontology, the Glasgow Odontological Society, the Liverpool and District Odontological Society, the North Staffordshire Society of Dental Surgeons, the Odonto-chirurgical Society of Scotland, and the Dental and Medical Society for the Study of Hypnosis

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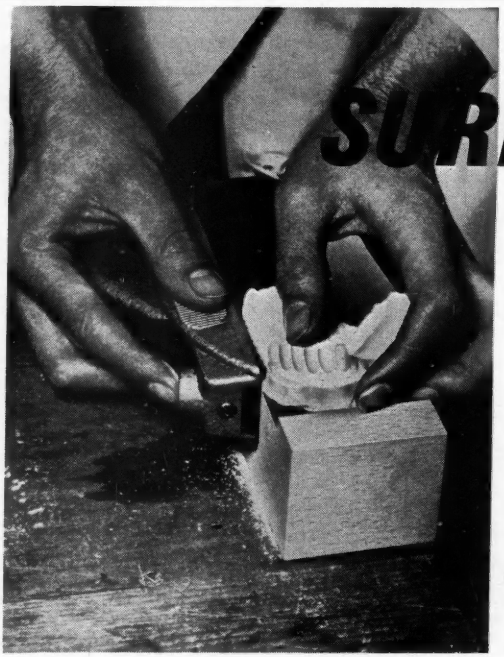

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THE DENTAL PRACTITIONER AND DENTAL RECORD

Vol. XI, No. 2 October, 1960

EDITORIAL

DENTAL HEALTH EDUCATION TO-DAY—AND TO-MORROW

STRANGE as it may seem, dental health is news. In recent months, newspapers and magazines have printed articles and reports on the poor state of dental health in this country, particularly among children. In July the Oral Hygiene Service instituted a campaign to bring this fact to the notice of all sections of the community who are in a position to stimulate public interest, to stimulate action where apathy had existed before. Those responsible for the Oral Hygiene Service must be congratulated on the steps they have taken and the results they appear to be obtaining. They have produced, and are distributing, three leaflets for children of varying ages, a booklet for teachers as well as wall charts and posters concerning personal oral health and hygiene.* As a result of their approaches to schools alone, they are receiving some five hundred applications a week for this material.

However, we must not forget the admirable work done by the General Dental Council and the Central Council for Health Education, as well as by the many manufacturers whose commercial advertising does so much to bring the problem of dental disease to the lay public.

Gratifying as this may all seem, it is, however, not enough. It is the duty of every conscientious practitioner to follow this up by educating each and every adult in his practice on the necessity for maintaining their own good oral hygiene and that of their children. To explain to them the dental procedures that they perform, the effects of malpositioned, missing, and untreated teeth, as well as the need for proper diet and regular prophylaxis. Further, practitioners should also be generous with their time and energy in persuading all kinds of local organizations to participate in this all-out effort to bring home to the public of this country the need for regular dental hygiene. They should endeavour to have these posters exhibited in places where people congregate, such as community centres, canteens, hostels, youth clubs, out-patient waiting rooms, and Women's Institutes.

We must not fall into the error of thinking this is a "one shot" campaign. It is up to us all to see that this is a continuing effort gathering momentum as the months and years go on. It may mean in the first years an increase in the requests for dental treatment by the public on an under-staffed profession, but as a long-term policy it can create better oral health, and, we hope, a reduction in dental disease. An inadequate dental service should be no excuse for failing in this conscientious duty to our fellow men. Demand always creates supply in the end.

A strong, dedicated, and compact profession such as ours could, by persistent efforts, reap tremendous results. The level of dental health and dental education would go up by leaps and bounds.

* Obtainable from the Oral Hygiene Service, Berk House, Baker Street, London, W.1.

THE CONCEPT OF PERIODONTAL THERAPY TO-DAY*

By **HAROLD G. RAY**, D.D.S., M.S.
Professor of Periodontology, University of California, San Francisco

An evaluation of our basic research efforts and cumulative clinical experience has established a comprehensive approach to the therapy of periodontal disease. This malady can be controlled, and the dentitions of many people so afflicted can be saved for useful function for many years. Early recognition, proper diagnosis, and the application of specific techniques dependent upon clinical judgement are the keys to successful management.

To-day it is possible to correlate certain biologic and histopathologic concepts with the clinical entity of periodontal disease. The relation of the tooth to its periodontium is a most unique one. Nowhere else in the body have we a fully calcified organ, such as the tooth, dependent upon the surrounding tissues for its retention and support, both functionally and biologically. The connective tissue of the gingival apparatus and the periodontal ligament is the mother tissue. It is responsible for the laying down of cementum on the root-surface of the tooth, into which its fibres are imbedded, and for the similar process of alveolar bone formation and attachment to it. The gingival connective tissue is covered by epithelium which is also attached to the tooth and is dependent upon the connective tissue for its nutrition. Thus we have a group of biologically active tissues which are subject to injury endogenously and exogenously holding a structure which contributes nothing to its support.

These tissues remain in a state of health and perform their function so long as it is within their ability to withstand the injury to which they are subjected. This ability is unquestionably affected by the health of the patient and accounts for the variability of response to any local injury. The systemic influence upon the periodontium is a difficult factor to analyse, but the effect of local irritation, by far the most predominant, is visibly present and there for the dentist to see if he will look. Treatment of the systemic influences is sometimes nebulous in result and certainly lies within the co-operative efforts of the physician, but the treatment of the oral local problem is the dentist's responsibility and when prosecuted to completion, results in successful treatment of a majority of the cases seen.

Two important pitfalls must be emphasized which contribute to the failure of many periodontal cases to maintain their initial success after treatment. The first is the spectacular and almost universal response of the gingival tissue to the removal of irritation. This can be a wolf in sheep's clothing. The visible evidence of inflammation disappears, and in the judgement of the dentist, as well as in that of the patient, the gross clinical picture is one of apparent health. Upon close examination, however, the pocket may still be deep with all of the potential to repeat the cycle which produced the lesion in the first place. The gingival contour and position may be incompatible with good physiology, contributing to further injury with resultant inflammation. If we correlate our knowledge of histopathology we realize that the impact of the inflammatory experience has left its mark upon the whole periodontium. The gingival connective tissue has been invaded by proliferating epithelium and the epithelial attachment has been extended apically. Epithelial proliferation may be reversible as far as the gingiva is concerned, but I doubt that this is true for the extension of the epithelial attachment along the surface of the root. If a demonstrable pocket remains subject to the invasion of bacteria, debris, and subsequent calculus formation, the inflammatory process takes over again. This process, however, does not start at the level of the first insult but

* Presented at the meeting of the American Dental Society of Europe, held on July 3–8, 1960. Owing to the late Dr. Ray's illness, this paper was read by Ronald Emslie, M.S., B.D.S., F.D.S.

where it left off, at the end of the previous experience. Further destruction of the periodontium with deepening of the pocket and further loss of alveolar bone occurs. If the operator evaluates success upon the gross clinical appearance only, he will be lulled into a sense of false security. Operative dentistry has been ahead of us in periodontia in recognizing principles such as this. Removal of all carious material, extension for prevention, and the extension of grooves are the result of scientific study toward the total consummation of the problem.

The second pitfall is the misinterpretation of the X-ray in respect to clinical resolution of inflammation and the remaining alveolar resorption defect. The X-ray is a two-dimensional portrait of a three-dimensional problem. Its evidence must be interpreted on the basis that it demonstrates the hard structures only and presents a static picture of changes which have occurred as a result of a pathology, which is far ahead of this portrait. The clinician who has opened the periodontium at the gingiva and carefully examined the extent of alveolar resorption, in all dimensions, is constantly struck with the variations in pattern and the deficiency of the X-rays to disclose it. The X-ray can be guilty of misinterpretation on the basis of successful new attachment or it can obliterate an extension of destruction difficult to detect by clinical examination. The X-ray is a most valuable diagnostic tool to us. Careful examination of the level of attachment on extracted periodontically involved teeth in comparison with the evidence in the X-ray will enhance clinical judgement. Further examination of autopsy periodontal sections which have been X-rayed will emphasize this principle.

These two pitfalls, singly and together, are often responsible for a judgement which allows the dentist to dismiss the patient with an assurance that all is well.

Diagnosis is the act of recognizing a disease by its symptoms. In periodontics it amounts to the critical scrutiny of the clinical signs to determine the possible aetiology and the indications for treatment. In periodontal disease the gingivitis phase presents the opportunity to differentiate specific infections, blood dyscrasias, and other systemic contributions. Further projection, involving the detachment and loss of supporting tissues, demands the evaluation of the clinical evidence of the pathologic pocket, its topography and its depth, and the oral contributions to the aetiologic complex. Since these symptoms are our forte, we must prosecute therapy according to definitive objectives.

What are the objectives, then, of periodontal therapy? They are basically four in number: (1) To eliminate the clinical symptoms of inflammation and to *eliminate* the pathologic pocket; (2) To reconstruct a healthy relationship of the tissues of the periodontium to the tooth *at any level* commensurate with the support of the tooth in function; (3) To alter, reconstruct, and adjust the teeth, to eliminate injury to the periodontium during mastication, and to distribute the forces to which the periodontium is subjected in accordance with its present potential for support; and (4) To prescribe for and educate the patient to use specific techniques for the maintenance of periodontal health.

This is the modern template of periodontal therapy and can only be executed step by step, interspersed with periodic deliberate and searching examinations to evaluate the patient's response and the success of treatment according to the objectives. Only the first of these is directed towards the control of the pathologic process. The remainder are projected towards the resolution of the defects caused by the pathology and the prevention of recurrence.

Objective 1 is concerned first with the control of inflammation and secondly with the reduction of pocket depth.

Inflammation is ameliorated by the removal of accretions and irritants on the surface of the tooth, by means of scaling or root planing, and curettage of the soft-tissue wall of the pocket. Ancillary drugs can be used in accordance with the diagnostic findings. The reduction of the inflammatory process enhances the physical consistency of the gingival connective tissue, thereby reducing the gingivæ in size and in closer adaptation to the tooth. The newly

regenerated epithelium of the crevicular wall facilitates an increased epithelial attachment. The institution of these techniques usually grouped together under the term "subgingival curettage" is the primary approach to periodontal therapy. After this initial therapy the

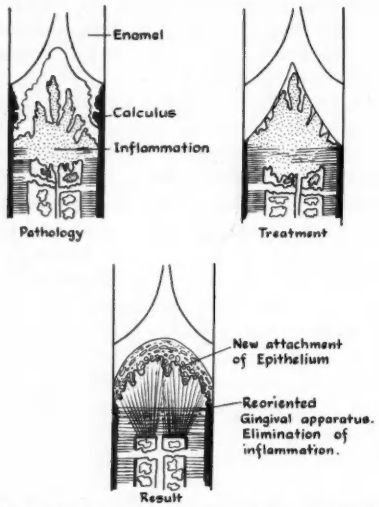

Fig. 1.—Objective 1. Showing shrinkage of soft-tissue wall and new attachment of epithelium.

periodontium is evaluated using a shallow sulcus as the criterion of success (*Fig.* 1). Cognizance of the previously mentioned pitfalls demands that any extension detachment to a pathologic pocket beyond this exacting criterion is subject to further treatment. Any remaining pocket can be eliminated in two ways: one, by new attachment to the tooth by regenerated tissues at a higher level coronally, or two, by surgical eradication of the soft-tissue wall.

Let us first evaluate the principle of new attachment as a therapeutic goal. We know, clinically and histologically, that both epithelium and connective tissue will produce a new attachment to the surface of the tooth root when deliberately detached by surgical intervention. This is supported by anyone who has done a gingivectomy or reflected a flap in oral surgery and histologically by animal and human experimentation. What is the difference between this premise and its apparent default when pathologically involved periodontal tissues are treated? The difference lies in the sequence of pathologic tissue detachment as a result of the progress of inflammation when compared with immediate detachment as a consequence of surgery.

As a result of inflammation, the connective tissue of the gingiva and that below the bottom of the pocket degenerates, and the epithelium above it proliferates into it and migrates apically along the surface of the root. As this epithelial attachment increases in length, it detaches at its coronal extremity, thus increasing the depth of the pocket. Cementum is consequently exposed to the debris of the pocket environment. This denuded cementum has gone through three stages of tissue alliance before disunion. (1) Originally, healthy fibres of the periodontal ligament were secured to it, which constantly added to its structure; (2) Degenerating connective tissue was passively attached to it; and (3) Epithelium was affixed to *it.* In surgical *excision* of the pathologic soft-tissue wall to a level of natural tissue relation, repair takes place at this stratum, or when *separated* (as in surgical flaps for tooth extraction) the tissues are quickly returned to approximately the original position and continuity which originally obtained. Similar repair, when pathologically detached periodontal tissues are treated toward a re-establishment of original level and connexion, depends upon the reversal of the above sequence of pathology. The tissues must be prepared to emulate the original relation. This means that the denuded cementum must be thoroughly planed to remove all calcareous deposits and toxic material and the ulcerated epithelium of the crevicular wall must be curetted. Both the epithelium and connective tissues are capable of new attachment to this prepared root surface. Epithelium is attached by an unestablished process of fixation, and connective tissue by its deposit of new cementum upon the root surface while incorporating its fibres with the cementoid.

In the treatment of supra-alveolar crestal pockets by subgingival curettage only new

attachment of epithelium is probable. This is primarily true because of the clinical improbability of removing every vestige of crevicular epithelium, which must be accomplished if connective tissue is to create a new attachment at a higher level coronally. The pathologic pocket is lined with epithelium, the surface of which is ulcerated and covered with cellular debris. Only the germinal cells seem to be capable of producing an attachment to the tooth. Therefore, to encourage epithelial new attachment, the surface of the epithelium lining the pocket must be removed. In this instance the retention of a blood-clot is redundant and might even be a hindrance. What might be important is a technique for occluding the orifice of the pocket to exclude oral debris which can separate the germinal cells from the root surface.

The ideal would be to prepare the tissues for *both* epithelial and connective tissue new attachment. For connective tissue new attachment, all of the epithelial lining, including that portion attached below the bottom of the pocket, should be removed. This is necessary since connective tissue must adjoin the tooth root in order to attach. Here it has been said that a blood-clot is essential, following the present concept of wound healing. This premises that the clot becomes organized into young connective tissue with undifferentiated cells becoming fibroblasts, cementoblasts, and osteoblasts within it, providing all the components of connective-tissue attachment.

Most examples of connective tissue new attachment presented as a result of animal experimentation show new cementum and the consequent new attachment to have occurred only at the area of experimental surgical detachment. When the pocket is kept open artificially, and the exposed cementum protected, the epithelial migration can be observed to extend to the bottom of this opening. As previously stated in attempting new connective-tissue attachment in the treatment of supra-crestal pockets, our difficulty in the past has been the removal of all the epithelium lining the pocket. The hazard here is the accentuated ability of the epithelium to proliferate, covering the connective tissue before it has a chance to develop and increase the extent of its attachment.

Similarly, it is imperative that the exposed root surface of the tooth should be carefully and completely planed when new attachment is desired. This, too, is sometimes difficult to

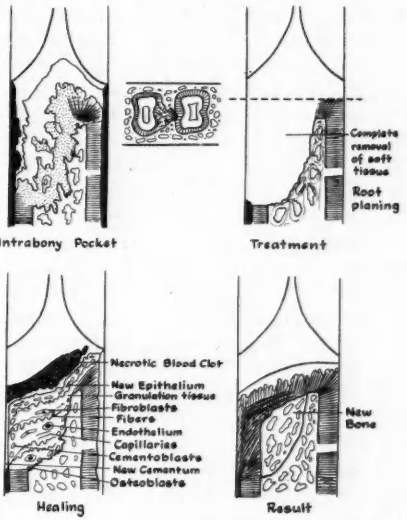

Fig. 2.—Objective 1. Showing new attachment of epithelial and connective tissue.

do and even with our modern instruments, anæsthetics, and techniques, its execution is fraught with hazards and requires great skill. Often upon the subsequent surgical opening of a periodontal lesion to direct view, areas which were insufficiently planed are exposed.

The intrabony pocket, on the other hand, presents many features in its topography which are contributory to pocket elimination through new attachment at a higher level of both connective tissue and epithelium. The key is the pattern of alveolar resorption which must be in the shape of a cone, the apex of which points toward the apex of the tooth. This type is indicated by vertical resorption in the X-ray and is most promising when it occurs in the interseptal bone, providing sufficient bony surfaces to retain a blood-clot in apposition to the tooth root surface (*Fig.* 2).

In this type of lesion the complete removal of the pocket epithelium, and inflammatory connective tissue with planing of the root surface, can be readily accomplished either from the gingival opening by means of a gingivectomy or the reflections of a flap. Since the buccal and lingual alveolar walls of the lesion are presumed to be intact, the gingival epithelium remains coronally while the blood-clot undergoes initial organization within the cone. Subsequently the rapidly growing gingival epithelium can migrate through the coronal surface of the blood-clot to attach on the prepared surface of the root at a higher level coronally. Beneath the epithelium then, the connective tissue can proliferate from the marrow spaces of the alveolar bone and from the intact periodontal ligament, producing new fibres, new cementum, and new alveolar bone. Our evidence of success in this projection is, in the main, only clinical, but can be somewhat supported by the X-ray. If the previous vertical translucency is filled in with new bone, one can conclude with some validity that new connective tissue has become attached to previously exposed cementum. New attachment in intrabony craters is also valid when surgical techniques are employed in evaluating the indications for osteoplasty or the recapture of connective tissue and bone when conditions favourable to this projection are found.

In the foregoing, an attempt has been made to evaluate our present position in respect to dependence upon new attachment for the elimination of the pocket. Because of the difficulties of technique as applied to the histopathology, it cannot be considered a universal procedure to satisfy Objective 1. It can be successful in moderately deep supracrestal pockets only to the extent of a degree of epithelial attachment in combination with gingival shrinkage. In properly selected intrabony pockets it can be ideally successful.

In the continued prosecution of Objective 1, surgery becomes the next technique requiring appraisal. This therapy is a precise method of pocket elimination, but should be preceded by its complementary subgingival curettage and re-evaluation for remaining pocket depth. Periodontal surgery includes gingivoplasty, gingivectomy, osteoplasty, and the repositioning of the attached gingiva. These techniques overlap from Objective 1 to Objective 2. It is important now to stress that not only should the pocket be completely eliminated, but that a gingival architecture commensurate with physiological function should be created at the new level prescribed by the destructive process.

The technique of gingivoplasty (removal of the gingival soft tissue only) was designed to correct abnormalities of the gingivæ whenever they occur, to anticipate and eradicate abnormal contours subject to injury, and to include the eradication of minor pathologic pockets. Osteoplasty follows the same criterion in the recontouring of the alveolar bone to satisfy proper gingival form and function. There has been, in the immediate past, an emotional block against the projection of our gingival reconstruction to the alveolar bone. This is not only unwarranted, but derogatory to success. One has only to analyse the failures in periodontal therapy to realize the dependence of the gingivæ upon the underlying bone for its contour and the contribution of the erratic pattern of alveolar resorption to continuing disease.

The basic surgical technique is the gingivectomy. It means just what it says—an excision of the whole gingivæ, *including* the structures at the bottom of the pocket. Periodontists have quibbled, in the past, in regard to the point and limits of the incision. Should it be at the bottom of the pocket or below the bottom of the epithelial attachment? This only results in confusion to the general practitioner, and I am sure in many instances to failures. In my opinion, the entire gingivæ should be removed, including the epithelial attachment and any remaining interseptal granulomatous connective tissue. To do less than this is to do a gingivoplastic procedure not directed toward the control of the whole problem. Gingivoplasty only is often indicated, but this judgement must be made on the basis of clinical examination and X-ray confirmation. If the judgement reveals evidence of active bone resorption, complete excision is mandatory.

The reasons for this concept are many. The epithelial attachment has a varied length from the bottom of the pocket along the root into the subepithelial connective tissue. Similarly the pocket-lining epithelium proliferates,

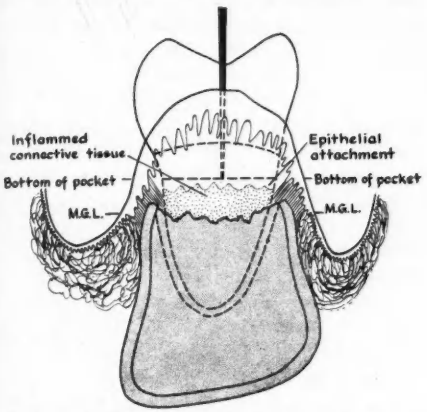

Fig. 3.—Objective 1. Basic gingivectomy. Anatomy of pathology.

producing a gingiva which is a mass of degenerated connective tissue impregnated from all sides by epithelium. An incision made just at the level of the bottom of the pocket leaves a tissue surface of this spongy connective tissue interspersed with dabs or islands of epithelium. Post-operative problems for the gingivectomy, performed in this manner, are precipitated in the direction of untoward hyperplasia and necessitate repeated dressings and escharotics to control this proliferation. There is also the technical difficulty of placing the incision at the level of the bottom of the pocket consistent with its position all around the teeth. As a result of the impact of inflammation the principal fibres of the gingiva have become degenerated and lose their orientation. Re-orientation of these fibres, in my opinion, is more readily accomplished by rebuilding from the alveolar crest (*Figs.* 3–5).

By removing the spongy interseptal tissue, one is able to evaluate directly the resorption pattern of the alveolar bone and correct any deformity conducive to improper healing and control. It is very revealing to discover deep holes in the bone along the surfaces of the roots, filled with both soft tissues and undetectable in the X-ray. It is now possible to treat these on the intrabony new attachment basis. Furthermore, simple corrections of either the buccal or lingual cortical plates are easily made at this time, which enhances

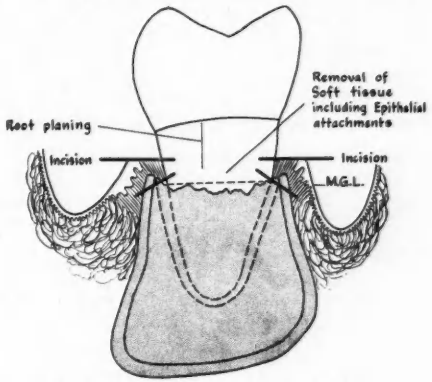

Fig. 4.—Objective 1. Basic gingivectomy. Treatment.

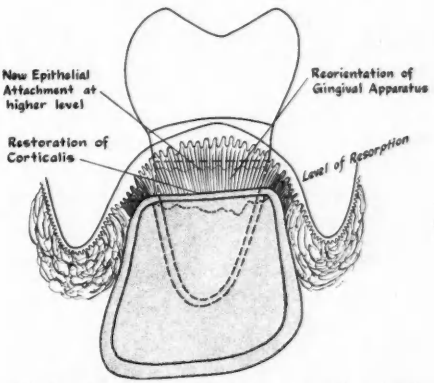
New Epithelial Attachment at higher level
Reorientation of Gingival Apparatus
Restoration of Corticalis
Level of Resorption

Fig. 5.—Objective 1. Basic gingivectomy. Completed result.

the healing process and certainly does not jeopardize the support of the tooth. When all of the affected tissues are exposed in this manner, the root planing operation which should be part of the basic gingivectomy can be executed effectively. The healing process, when the operation is performed in this way, usually proceeds uneventfully and with a minimum of post-operative complications. The

epithelium covers new granulation tissue and attaches to the tooth, often, in my opinion, at a higher level coronally.

The indications for the application of the basic gingivectomy are: (1) The continued presence of pathologic pockets after the full benefits of root planing and curettage have been realized. (2) That the bottom of the pocket when projected to the surface gingiva of the buccal and lingual is within the area of the attached gingiva and coronally of the mucogingival junction. (3) The line of incision in the attached gingiva resulting from the projection of the bottoms of the pockets will leave sufficient attached gingiva to conform to the physiologic requirements of gingival contour and position. (4) That the clinical evaluation of the alveolar resorption pattern correlated with the X-ray is within the scope of correction commensurate with the above requirements of the gingivectomy.

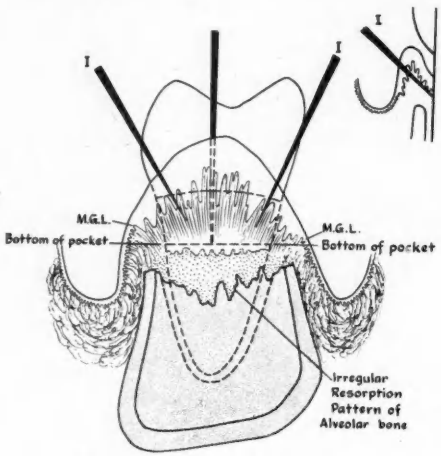

Fig. 6.—Objective 1. Repositioning attached gingiva. Anatomy of pathology. I. Incision for removing crevicular tissue, including epithelium.

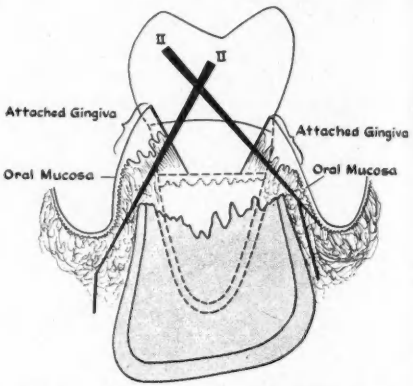

Fig. 7.—Objective 1. Repositioning attached gingiva. Technical procedure. II. Sharp dissection of attached gingiva and oral mucosa from mucoperiosteum of alveolar bone.

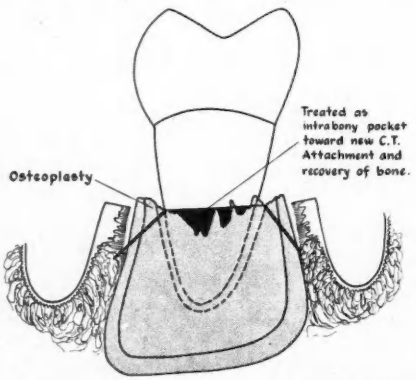

Fig. 8.—Objective 1. Repositioning attached gingiva. Showing the attached gingiva in the new position and the alveolar restoration pattern exposed.

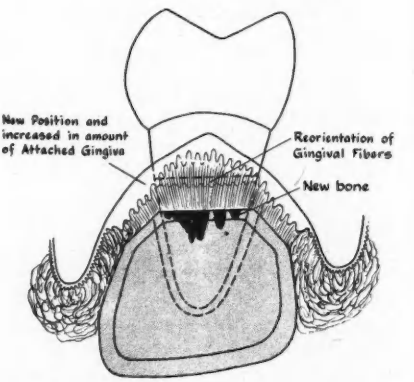

Fig. 9.—Objective 1. Repositioning attached gingiva. Result.

Further prosecution of Objective 1 under surgery is the technique known as repositioning of the attached gingiva. The indications for this technique are compatible with the increase in severity of the disease.

The indications are: (1) Persisting deep pathologic pockets, the bottoms of which, when projected to the buccal and lingual, are *apical* to the mucogingival junction on either the buccal or lingual or both. (2) The line of incision ordained by the pocket measurement is still within the area of the attached gingiva, but if executed would leave insufficient attached gingiva to meet the demands of physiologic contour. (3) The alveolar resorption pattern is of such nature and severity that osteoplasty must be exercised to the extent impossible in the basic gingivectomy. (4) The remaining attached gingiva after curettage is too narrow to withstand the physiologic abuse to which it will be subjected. (5) Muscle attachments to the attached gingiva are of such a nature and level that their pull jeopardizes the attachment of the gingivæ to the teeth. (6) Definite involvement of the bifurcations or trifurcations of molars.

It is readily obvious that the purpose of this technique is to conserve the attached gingiva as well as to expose for operation the alveolar bone defects.

The attached gingiva is composed of dense groups of collagen fibres bound together with a dense ground substance. The alveolar mucous membrane on the other hand is composed of loose areolar connective tissue containing elastic fibres, fat cells, glands, muscle fibres, and a high degree of vascular elements.

Conservation of a portion of the attached gingiva and moving it apically where it quickly becomes attached to the mucoperiosteum provides an immovable connective-tissue border, allowing new attached gingiva to form between it and the teeth. The new attached gingiva is fostered by the development of granulation tissue emanating from the exposed alveolar bone, the periodontal ligament, and by some proliferation of the connective tissue of the repositioned attached gingiva border. The epithelium, meanwhile, is unable to proliferate coronally until sufficient granulation tissue has been formed, thus providing for a maximum of connective-tissue attachment to the teeth (*Figs.* 6–9).

The contour of the new attached gingiva is predicated upon the development of good contour of the remaining alveolar bone. This contouring is done by means of sharp chisels, bone burs, and diamond stones. The development of alveolar contour is dependent upon the requirements of the support of the teeth and the reconstruction of interseptal, buccal, and lingual bone to tooth relation compatible with acceptable gingival contour. Upon this premise each alveolar process is analysed to meet these requirements and the composite physiologic form of any segment of an arch.

It is here that the opportunity obtains toward the evaluation of bone craters or intrabony cones which can be handled on the basis of new attachment to the tooth and bone recovery. The promiscuous levelling of the alveolar bone to the lowest point in the defect is neither indicated nor desirable.

Objective 2 emphasizes the importance of a healthy relationship of the tissues of the periodontium at a new level dictated by the severity of the disease and the physiologic requirements at this new position. All of the techniques enumerated above are involved in this projection and are executed with both Objectives 1 and 2 as the criteria.

The addition of the contouring of abnormally positioned teeth, and the plastic repositioning of detrimental muscle attachments, depends upon clinical judgement and the future needs of the periodontium. The correction of muscle attachments can be executed in much the same manner as that described for repositioning of the attached gingiva, the salient feature being the detachment of the fibres from the alveolar bone rather than their separation at or near their midpoint. The extension of the vestibule, when indicated, is again accomplished in the same manner since the change in the position of the mucogingival junction is the critical feature. Successful application of this latter objective depends entirely upon the function of the muscles of the cheek and vestibule which predetermine the degree of success (*Fig.* 10).

Oral physiotherapeutic techniques are part of Objective 2 since they can be prescribed to accomplish definite goals of proper physiologic contour as part of the treatment phase.

Objective 3 in modern periodontics is the incorporation and direction of the knowledge

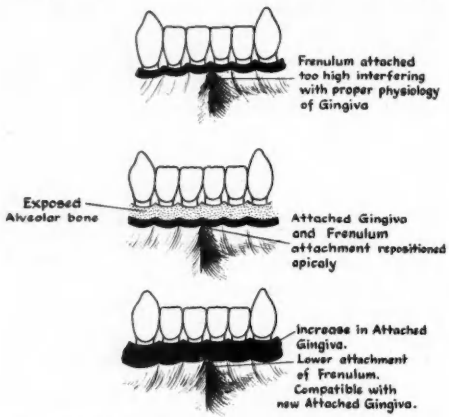
Frenulum attached too high interfering with proper physiology of Gingiva
Exposed Alveolar bone
Attached Gingiva and Frenulum attachment repositioned apicaly
Increase in Attached Gingiva.
Lower attachment of Frenulum.
Compatible with new Attached Gingiva.

Fig. 10.—Objective 1. Repositioning attached gingiva and the frenum attachment.

and skills of restorative dentistry towards the protection and maintenance of the periodontium. Restorative dentistry must be well conceived and well executed to protect the supporting structures of the teeth. Yet the dentist is unquestionably one of the aetiologic factors in periodontal disease.

The masticatory mechanism must be examined on the basis of the whole unit and deviations from normal be corrected, whether they involve the occlusal relation of the mandible to the maxilla, the orthodontic correction of individual malarrangements, or the splinting of weakened members to stronger ones. This concept is extended to judicious correction of untoward contours of existing restorations of offending teeth by grinding and/or rehabilitation.

The merits of the premise that occlusal trauma is a primary cause of the periodontal lesion have been debated endlessly. Excessive occlusal force has its primary effect upon that portion of the periodontium in which the periodontal ligament is confined between the cementum and bone. The gingival tissues above the alveolar crest are free to move with the tooth as it is pushed into abnormal positions as a result of occlusal trauma.

The rather general finding of experimental biologists is that excessive force instituted deliberately does not produce a detachment at the bottom of the sulcus. It produces the classic findings of periodontal traumatism in the confined periodontal ligament, namely, the compression of tissues with thrombosis, hæmorrhage, necrosis, and resorption of bone and cementum in the areas of pressure, and formation of bone in the areas of tension.

This precipitates a paradox, since it is a common clinical impression that excessive occlusal force is contributory to the production of a pathologic pocket. How can these somewhat diverse opinions be reconciled?

It has been shown, by Weinmann, that the progress of gingival inflammation is along the course of the blood-vessels into the marrow spaces of the alveolar bone. The confined periodontal ligament is resistant to the process of inflammation and the apical migration of the epithelial attachment.

However, in the event of excessive occlusal force in the presence of inflammation in the gingiva, it is conceivable that the injury of trauma at the level of the alveolar crest could aid in the disintegration of the connective tissue of the periodontal ligament and allow two detrimental processes to occur. (1) The process of inflammation in the gingiva finds a more fertile field for progress in the disturbed periodontal ligament as well as in its usual course. (2) The resistance of the traumatically injured periodontal ligament to the apical migration of the epithelial attachment could be lessened. These two factors operating concomitantly with the resorption of the alveolar crest, as a result of inflammation, could account for the appearance of the pathologic pocket in the presence of demonstrable occlusal trauma. The conclusion here implied is that excessive force in the presence of gingival inflammation can be a contributing factor in producing the periodontal lesion.

The pathology of periodontal disease is such that with the loss of supporting tissues the tooth is pushed or migrates into a position

which can subject it to occlusal trauma. The reduction of the inflammatory process allows for some degree of realinement of the tooth within the periodontium and consequently may reduce some of the positional factors which emphasized occlusal stress. However, occlusal prematurities may still remain and should be analysed and corrected in the direction of producing the best possible function.

The techniques of occlusal equilibration belong in Objective 3 for periodontal therapy. It should be executed on the basis that all demonstrable contributory factors to the aetiology should be eliminated and that this treatment should produce a good functional relation between occluding teeth, commensurate with their *remaining* support. Occlusal adjustment must be executed with the full cognizance and evaluation of the physiologic phenomena of continuous "mesial drift" and the latent potential for eruption of the teeth. To do otherwise is to negate these natural adjustment forces and precipitate untoward tooth-to-tooth relations conducive to further trauma.

The timing of the application of occlusal adjustment is important. Obvious gross and contributing abnormalities should be corrected when treatment is begun and the entire mechanism evaluated as therapy progresses. At the conclusion of the management of the periodontal lesions, the complete adjustment of the occlusion should be performed. There are cases in which the ravages of periodontal disease have disturbed the occlusal relation to such an extent that major corrections not possible by grinding, are necessary. These problems are often concerned with the recovery of lost vertical dimension between the mandible and maxilla. Advantage can be taken of the physiologic force of continuous eruption by means of a "Hawley" appliance, with an incisal guide plane thereby disoccluding the posterior teeth. These appliances are worn continuously.

Periodontal lesion therapy can be executed simultaneously with the added benefit of raising the height of the alveolar bone by means of the stimulation to it by the eruption of the teeth. After occlusal contact is re-established correction of interdigitation incongruities can be made by occlusal grinding or reconstruction. In many of these cases a labial migration of the upper anterior teeth has obtained which is corrected by a labial arch wire on the same "Hawley" appliance.

The pursuit of Objective 4, aptly termed "oral physiotherapy", lies within the dentist's ability to analyse the requirements for periodontal maintenance of each patient. The needs for each case differ in respect to the proper stimulation and cleansing of the gingival tissues as well as in the psychologic approach of the patient. The patient must be educated, not only to execute the selected procedures for maintenance well, but be given the reasons for each and the criteria of accomplishment. The successfully treated patient must be apprised of his responsibility to maintain control. We have at our command a wide selection of devices for stimulation and cleansing, and combinations of these can be prescribed and demonstrated to each patient according to his needs. Oral physiotherapy is to the controlled patient as the critical use of insulin and dietary regimen is to the diabetic.

To-day, the dentist is a student of nutrition and it is within his prerogative to analyse the diet of his patients to determine nutritional deficiencies as well as untoward excesses. Malnutrition is certainly a contributing factor to periodontal disease, and correction of this defect enhances both the local treatment as well as the potential for maintenance.

Up to now I have tried to state the present position of periodontal therapy and what is, in my opinion, the validity of each concept. All of these procedures are well within the realm of the general practitioner and should be performed by him, and success will be his in most cases, if he will follow this template. I have not spelled out the specific techniques for any of these methods but have attempted to ratify the principles. The opportunity for continual study to improve technical skills in periodontal therapy is now extensively available.

The general practitioner can, and must, incorporate a planned regimen for periodontal health within his presentation of a treatment plan to his patient. Initially, time must be

spent to point out to the patient the existing defect and its repercussions, both on the general health and the survival of dental units as well as restorations. The periodontal part of the plan should be presented and executed first. This offers an opportunity for better subsequent evaluation of the needs for restorative dentistry, as well as being an encouraging impact on the patient.

What does the future hold in store? Periodontology will have attained its majority when definite concepts of prevention can be developed. The work now being conducted in histochemistry may reveal the trigger mechanism for the initiation of the lesion. A more accurate understanding of calculus formation may lead to methods of elimination or prevention. The continued study of the biochemistry of metabolism may reveal a preventive means in the direction of nutrition. The mechanism by which certain specific diseases undermine the periodontium may be understood as a result of further metabolic studies in correlation. In bacteriology the oral flora and its enzyme production is being studied assiduously to determine its effect in respect to invasiveness. Any, or all, of these explorations may establish the rationale for the initiation of the lesion and consequently its prevention. Clinically, although empirically, regular prophylactic treatments and corrective therapy can be instituted which can keep the disease in control.

In the direction of technical therapeutic improvement, the recognition of reality in the treatment of the multiplicity of local contributing factors gives the most promise. Specialized operations, such as the repositioning of the attached gingiva with accompanying remodelling of the alveolar bone, have definite advantages, particularly in severe cases. In respect to techniques intended to recover the original level of lost tissues, much research needs to be done. A device for the control of the epithelium after root planing and tissue curettage would enhance these procedures. A better understanding of the mechanism of epithelial attachment to the root surface would contribute to a better comprehension of the histopathology. Replacing lost tissue by implants of bone or cartilage is dramatic, but has many defects in clinical application. Certainly the placing of bone salts within the lesion has little validity. The introduction of tissue organizers, when properly established, may have more pertinence. Certain known connective-tissue stimulants administered systemically may serve as an adjunct to the local treatment. Specific inert plastic materials may be successfully used as tissue implants to either increase support or guide tissue repair.

All in all, the future is full of promise, but the greatest of these is the recognition by the dentist of his responsibility to a major problem.

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INFECTED PULPLESS TEETH WITH PERIAPICAL INVOLVEMENT*

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ONE of the commonest and most troublesome conditions in endodontia is the infected pulpless tooth with radiographic evidence of periapical involvement, and the management of such a case is a fascinating problem.

BASIC PRINCIPLES OF ENDODONTIA

Before describing the rationale of treatment carried out at the Edinburgh Dental School, it is important to bear in mind that certain basic principles must be fulfilled.

First, a clinical diagnosis of the condition of the pulp and periapical area must be followed by a definite treatment plan.

Secondly, in the selection of cases, after determining that the condition of a particular tooth indicates that the line of approach is root-canal therapy, then only those cases for which a favourable prognosis can be made should be selected.

Thirdly, an aseptic technique must be instituted.

Finally, the last three principles are grouped under what may be termed "Biomechanical Procedures".

a. Thorough mechanical instrumentation, cleansing, and enlargement of the root-canals.

b. Sterilization of the root-canal and periapical tissues.

c. The hermetical sealing of the root-canal apex with the permanent root filling.

Fig. 1.—X-ray of a periapical granuloma.

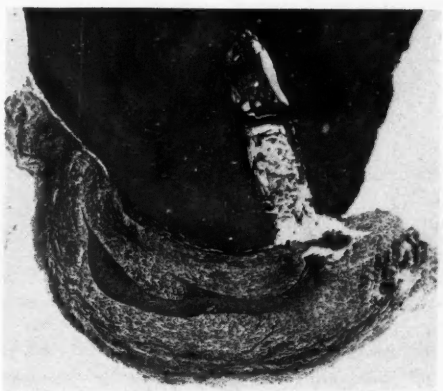

Fig. 2.—A photomicrograph of a lateral section through a granuloma.

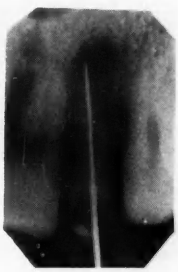

Fig. 3.—Shows reamer through apical foramen.

THE PERIAPICAL GRANULOMA

Fig. 1 is an X-ray of a typical periapical granuloma. According to a histological study by Sommer, Ostrander, and Crowley (1956), 85 per cent of all radiolucent areas at the apices of pulpless teeth are granulomas.

Fig. 2 is a photomicrograph of a section through such a periapical granuloma. It shows a solid mass of chronic inflammatory tissue surrounded by a fibrous connective tissue capsule continuous with the periodontal membrane and includes, as in the majority of cases, strands of epithelial cells. This mass of tissue occupies the space formerly occupied by bone, and hence the radiolucent appearance

* Address given to the Odonto-Chirurgical Society of Scotland on January 7, 1959.

on X-ray. The condition is generally the result of a pulpitis which has proceeded to gangrene, and consists essentially in the reaction of the periapical tissues to a gradual and continuous irritation from bacteria and toxic products seeping through the periapical foramen or foramina, provoking either a stimulative process of repair or cellular destruction.

Usually both are manifest at the same time, producing a delicate balance of power or equilibrium. The granuloma is therefore a defensive mechanism, a tissue of repair, and, in the author's opinion, to remove this tissue would seem to be contrary to biological principles. It is well to remember, however, that a periapical granuloma cannot be positively differentiated from other periapical conditions associated with pulpless teeth, either by means of radiographs or clinical examination alone, and, indeed, from a strict histological point of view, even by microscopy.

APPLICATION OF RUBBER DAM

Before describing the actual technique the author feels that the rubber dam is a *sine qua non* in any endodontic procedure, but two points regarding the application of rubber dam seem to be worthy of attention.

First, to punch a single hole in the rubber dam and apply a suitable clamp. By this method, ease and speed of application are accomplished and, in addition, it minimizes the risk of contamination of the operating field. Seldom are ligatures required.

Figs. 4 and 5.—Show rubber dam carried up over patient's nose.

Secondly, very often little attention is paid to the role that the expirations of the patient may play in the expulsion of pathogenic organisms from the respiratory tract. It may not be generally realized that more than 60 per cent of the *healthy* adult population are known to be nasal carriers of *Staphylococcus pyogenes*, and that the anterior nares are probably the natural reservoir of pathogenic staphylococci in man (Gould and McCabe, 1956). Moreover, with the present-day increase in coagulase positive staphylococci it is estimated that approximately 50 per cent of these staphylococci are coagulase positive, or in other words "potentially resistant" (McDermott, 1956). For this reason, therefore, it is now routine practice to carry the rubber

dam over the patient's nose with the object of eliminating this very real source of danger from the operating field. *Figs.* 4 and 5 illustrate this simple modification, which is well tolerated by the patient. Incidentally, if a rubber dam frame is used this aim is already accomplished.

TECHNIQUE

In the details of the actual technique, the first essential step is to institute drainage from the periapical area through the root-canal by widely opening the apical foramen. This drainage is allowed to continue until all clinical symptoms have subsided, that is usually from 4 to 7 days. From this stage onwards, at no time is the root-canal opened except under rubber dam and with the usual aseptic precautions. At the next visit, general débridement of the root-canal is carried out, making sure that the apex is still widely open. Mechanical instrumentation, irrigation, and drying of the root-canal follow, and then a radio-opaque polyantibiotic mixture is introduced, using a Chapman screw-action dental cartridge syringe. The point of the needle is inserted into the canal up to the periapical area (*Fig.* 6) and the periapical area and root-canal are filled (*Fig.* 7). Material expressed through the opening in the cingulum is an indication that enough polyantibiotic has been used. Any excess is removed from the palatal opening and the canal sealed in the usual manner, using a barrier of gutta-percha or sterile cotton-wool and quick-setting zinc oxide eugenol mixture. (If an X-ray was taken at this stage it would show a mass of radio-opaque material filling the root-canal and periapical area.) (*Figs.* 8, 9.)

After 7 days, a second application of the polyantibiotic is introduced, every endeavour being made to refill the periapical region.

One week after the second application of the polyantibiotic, permanent root filling may be carried out. As the apex is open, however, accurate assessment of the root length and width is essential if hermetical sealing of the apical foramen is to be accomplished. This apparent difficulty is overcome by using a trial gutta-percha point, which is matched to the corresponding final reamer size and which is pushed "tightly home" in the root-canal and the incisal or occlusal level marked; a radiograph is then taken (*Figs.* 10, 11). Any excess of gutta-percha protruding beyond the apical foramen may now be accurately trimmed off against the X-ray, and the trimmed gutta-percha point is then re-introduced into the root-canal to the incisal mark, using any non-irritating lute or sealer to fill up the interstices. By this method, close adaptation to the root-canal is accomplished, as is hermetical sealing of the apical foramen.

To recapitulate, a summary of the procedures is enumerated:

First Visit: Open apical foramen for drainage.

Second Visit (one week later): Instrumentation and first application of polyantibiotic.

Fig. 6. *Fig.* 7.

Fig. 6.—Shows needle of cartridge syringe inserted up to apex of root and *Fig.* 7 the periapical area being filled with antibiotic.

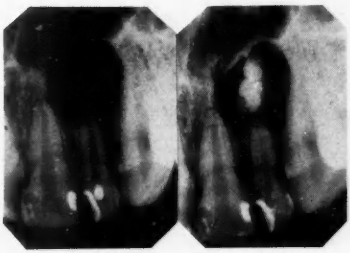

Fig. 8. *Fig.* 9.

Fig. 8.—Shows the periapical area before insertion of antibiotic and *Fig.* 9 the periapical area after the insertion of radio-opaque antibiotic.

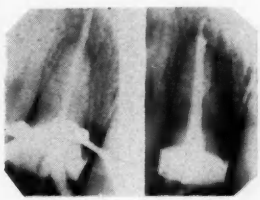

Fig. 10. *Fig.* 11.

Fig. 10.—Shows the trial gutta-percha point through the apex and *Fig.* 11 the gutta-percha point trimmed to correct length.

Third Visit (one week later): Second application of polyantibiotic.

Fourth Visit (one week later): Permanent root filling.

CASE REPORTS

Three completed cases are described.

Case 1.—The first case is that of a young woman who had a history of a throbbing type of pain in $\overline{1}|$ region of two weeks' duration. On clinical examination there was some tenderness and swelling in the labial sulcus over the apex of the tooth. The tooth had abnormal mobility, and there were no restorations present or any history of trauma. On opening into the pulp chamber pus was evacuated. *Fig.* 12 shows the original condition—the large granuloma appears to involve the apices of the two adjacent teeth, which were, however, vital.

Fig. 13 is the appearance after the application of the antibiotic.

Fig. 14 shows the condition 18 months after commencement of treatment—the periapical area has been obliterated by new bone formation and the lamina dura has been restored. It will be noticed that the radio-opaque material has become incorporated in the new bone formation. The discoloured tooth-crown has been replaced by a post-crown.

Case 2.—The second case is a male dental student who had a history of two days' duration of throbbing type of pain associated with $\underline{|2}$. On clinical examination the tooth was mobile, tender on palpation over the apex, but there was no evidence of any swelling. A large distal silicate restoration was present which had been inserted two years previously.

On opening, pus was evacuated. Cultures revealed a growth of a penicillin-resistant strain of beta-hæmolytic streptococci.

Fig. 15 shows the original condition and reveals a diffuse type of rarefaction. *Fig.* 16 is the appearance during antibiotic therapy, and *Fig.* 17 shows the completed root treatment 9 months after commencement of

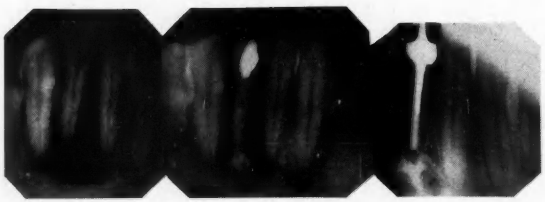

Fig. 12. *Fig.* 13. *Fig.* 14.

Figs. 12–14.—*Case* 1. *Fig.* 12, The original condition. *Fig.* 13, After the application of antibiotic. *Fig.* 14, Eighteen months after treatment.

Fig. 15. *Fig.* 16. *Fig.* 17.

Figs. 15–17.—*Case* 2. *Fig.* 15, Original condition. *Fig.* 16, After the application of antibiotic. *Fig.* 17, Nine months after treatment.

Fig. 18. *Fig.* 19. *Fig.* 20.

Figs. 18–20.—*Case* 3. *Fig.* 18, Original condition. *Fig.* 19, During antibiotic therapy. *Fig.* 20, Two years after treatment.

treatment. The area has disappeared, the periodontal space is within the limits of normality, and it is interesting to note that the radio-opaque material has moved round and become incorporated in the new bone formation well down the distal surface of the root.

Case 3.—The third case is that of a middle-aged male who complained of discomfort and tenderness on palpation over the apex of $\underline{|3}$ of a few years' duration. There was a history of an old root filling having been inserted 20 years previously. A post-crown restoration was present.

The crown and old root filling were removed and cultures revealed a pure growth of *Staphylococcus albus*.

Fig. 18 shows the original condition with a fairly well-defined periapical area of rarefaction. *Fig.* 19 is the condition during antibiotic therapy, and *Fig.* 20 the new sectional root filling with post-crown restoration two years after the beginning of treatment. The periapical area has disappeared and there is a "capping" of the radio-opaque material over the root apex.

CONCLUSIONS

In conclusion it would seem rational, except in unusual circumstances, to recommend that periapically involved pulpless teeth be first treated by conservative root-canal therapy, and, should follow-up X-rays fail to show a successful result, then surgery may be contemplated. The carefully treated root-filled tooth can no longer be regarded as a menace to health, and a successful result is indeed a gratifying reward to both patient and operator.

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AN INEXPENSIVE WAX WARMER

By **J. M. MUMFORD**, M.Sc., M.S., F.D.S. R.C.S.

University of Liverpool

INLAY wax has a low thermal conductivity so it should be warmed slowly. Otherwise the inside may still be hard when the outside is soft; sometimes so soft that it drips, perhaps on to the patient's clothing. To help avoid these difficulties a wax warmer has been made from a baby's bottle heater.*

Fig. 1.—Wax warmer with Petri dish lid.

Water is placed in the heater and into it is lowered a "Verone" mixing bowl weighted down with a small amount of Mellott's metal which is poured in just as it is about to freeze. Over the metal is placed a folded napkin, and the wax rests on this. One half of a Petri dish is used as a lid to reduce loss of heat and moisture, and to keep dust out (*Fig.* 1).

The heater is thermostatically controlled and has a light built into the base. When this goes out the water has reached the set temperature, but it takes longer for the wax to soften. When the water is at 54° C. the wax reaches a satisfactory consistency for direct patterns either with or without matrix. Since a limited amount of manipulation is first required it may be necessary to lightly flame the wax before placing it in the cavity.

The temperature of the bath may be adjusted so that the warmer may be used for softening compound tracing sticks.

* The Dee Gee auto-electric bottle heater, 165 watts, 200–250 volts AC/DC. Price 36s.

MODERN MEDICINE

EXTRACTS OF PARTICULAR INTEREST TO THE DENTAL PRACTITIONER FROM THE MEDICAL PRESS

Glandular Fever

More cases of glandular fever are detected to-day than ever before, probably due to better diagnosis than an increase in the prevalence of the disease. The wide variety of symptoms suggest that it may be more than one condition. It is believed to be due to a virus or perhaps more than one. The involvement of glands and the blood changes have suggested the possibility of a sensitization phenomenon. The incubation period is about 10–15 days—longer periods are recorded.

Three types are known: (1) the glandular; (2) the anginose; and (3) the febrile type.

In the glandular type, the initial symptoms are followed in four or five days by enlargement of the glands, usually in the neck but often in the axilla or groin. The deep glands as well as the superficial may be affected, sometimes the former only, making diagnosis difficult. There is occasionally a troublesome cough if the mediastinal group is enlarged; alternatively the mesenteric group may cause abdominal discomfort with diarrhœa and vomiting. Occasionally, jaundice may be seen in a mild form. The glands remain enlarged for some weeks, but the fever disappears after about 14 days.

In the anginose type the throat condition is most noticeable, associated with a temperature of 102–103° F. Differential diagnosis from diphtheria may be difficult because the tonsils are covered with a membrane and they may bleed if attempts to remove it are made. Occasionally a mucopurulent nasal discharge increases difficulty of diagnosis. The throat clears slowly and swabs reveal Vincent's organisms or streptococci. The clinical differential diagnosis depends upon three points. In glandular fever the temperature is still raised on the ninth or tenth day; the throat is similar at this time to diphtheria on the third or fourth day, the glands are small and discrete, whereas in diphtheria they are a firm mass. The finding of glands elsewhere and possibly an enlarged spleen is further suggestive.

The febrile type is the most difficult to diagnose. It is characterized by an irregular temperature which may last for weeks. During the first week a macular rash similar to that seen in German measles occurs in some cases. Headaches and sweating accompany the temperature, then glandular enlargement follows. The blood-picture is also late in developing. The febrile form of glandular fever requires a long convalescence.

An upper respiratory tract infection associated with temperature and some sore throat often accompanies the onset of this disease.

In glandular fever the changes in the white blood-count are the common feature, being raised to 12,000–15,000 per c.mm., and even higher in some cases. There is a relative and absolute increase in mononuclear cells and monocytes. The blood-picture takes some time to develop and early counts may not indicate the true nature of the illness.

Petechiæ are frequently found along the line of the junction of the hard and soft palates.

The prognosis is good, death being seldom caused except where the spleen is ruptured or there is infective polyneuritis.

The treatment is as for all fevers, rest in bed.—Ker, F. L. (1959), *Practitioner*, **182**, 379.

D. Derrick

Insect Stings

Most people take simple common-sense measures after being stung by an insect and do not consult their doctor unless severe reactions occur.

Identification of the insect is of academic importance only, for the treatment of stings is not very specific, and, in any event, the badly stung victim is usually annoyed and angry and his main concern is to escape. Even so, a quick look may show a bee sting in situ.

The honey-bee is peculiar in that she leaves her sting and poison apparatus behind, and these go on injecting venom for several seconds. Hence the advice that the sting should be "gently removed" is bad, for this would squeeze the poison sac. The bee sting should be scraped out with the finger-nail or wiped out with a handkerchief. Antihistamine creams, promptly applied, are of some help. Stings in the back of the neck have a bad reputation, possibly because of reflex vagal stimulation.

The severe generalized reaction calls for medical help, and probably occurs more commonly than is supposed. The usual treatment is to give a 0·5 to 1·0 ml. of adrenaline injection (1 in 1000) subcutaneously, followed by 50 mg. of cortisone acetate intramuscularly, and an antihistamine tablet by mouth.

Prophylaxis for patients who are known to react badly presents a different problem. Many workers have shown that the antigen causing the reaction is present throughout the whole insect and not simply in the venom.

The recently described queen substance of honey-bees is known to be distributed widely among worker bees, but its allergic possibilities remain uninvestigated.

The most important substance in wasp venom is a polypeptide called "kinin". Although sensitivity may occur to these special substances in different insects, it is not always species specific and thus mixed extracts of whole insects are usually given for desensitization.

A few patients who have suffered severe allergic reactions to bee stings do not show sensitivity to skin tests.—EDITORIAL (1959), *Brit. med. J.*, **2**, 417.

H. MANDIWALL

Night-blindness

The night-blind person has difficulty in recognizing objects in poor lighting such as twilight or starlight, whereas the normal individual is able to see objects to a greater or lesser extent. The ability to see in dim light varies from one person to another and decreases with age. Suspected night-blindness, however, needs careful examination; it may or may not be progressive, but in most cases the basic fault is in the retinal rod system.

This may be a structural defect or a failure of the visual purple mechanism. In early stages of the disease, dark adaptation still occurs but takes longer than in the normal eye; the light threshold is also increased.

Simple congenital night-blindness is usually not a progressive condition; the visual acuity and fundi are normal but the visual field contracted. The condition is hereditary and appears either in a dominant or recessive form or as a recessive sex-linked character which is transmitted by unaffected daughters of affected males to their sons. In recessive cases there is associated myopia. These individuals generally adjust themselves from early childhood, walking in a dim light with arms extended or learning to guide themselves along a road by looking up at the housetops outlined against the sky.

In retinitis pigmentosa there is a primary degeneration of the neuro-epithelium of the retina in which the rods disappear before the cones; this is a hereditary condition, symptoms usually appearing in early youth before any detectable change in the appearance of the retina. There is also a loss of visual field which in its early stages is characteristically ring-shaped, leading to tubular vision.

There is no known treatment for this condition. Attempts to improve local circulation by sympathectomy appear of little value, but the extraction of the cataract may be helpful if it is causing embarrassment of the central vision.

Night-blindness may be acquired from a deficiency of vitamin A, resulting in an impairment of visual purple regeneration. In mild forms, as in dietary deficiency in malnutrition, this causes merely a delay in dark adaptation. The more acute form is sometimes met in the tropics, especially in children, probably due to reduced vitamin-A content of milk and meat. Night-blindness is sometimes complained of in conjunction with cirrhosis of the liver due to inadequate storage of vitamin A by this organ. The treatment by giving vitamin A orally or by injection is slow but effective.—GREAVES, D. P. (1959), *Practitioner*, **182**, 643.

D. DERRICK

BOOK REVIEW

HYPNOSIS TO-DAY*

NEARLY two hundred years ago Mesmer introduced hypnosis to the scientific world. It does little credit to the medical profession as a whole that prejudice during that time has prevented its adequate investigation. At long last the atmosphere seems to be changing, and in October, 1958, an International Society for the Study of Hypnosis was founded in New York, and has now branches in 24 countries. One is glad to note that the British branch is one of the two largest.

The book under review is of particular interest in the contemporary history of hypnosis as it is based on the lectures given to doctors and dentists during study courses arranged under the auspices of the largest hypnotic society in this country. Over a thousand practitioners have attended these courses during the last six years. It is therefore important to know what is being taught to members of these two professions regarding this controversial subject.

It may be said at once that the subject is handled with restraint. Some may say that the writer has been over-cautious, but this is a good fault with a technique which has suffered a great deal in the past from exaggerated claims. Dr. Mason's approach is that of a psychiatrist, so one must expect occasional language difficulties, but on the whole he is clear, straightforward, and far more intelligible than the average writer on the subject.

Dr. Mason follows the present-day trend of explaining induction techniques very fully and clearly, though he does not emphasize the question of fear on the part of the subject, which most of us find to be a major obstacle to success. In the older works, adequate explanation was rare, the author wrapping up this part of the subject in mystery, giving the reader the impression that special gifts were needed. There is little doubt that in the past this has been a handicap to the full development of hypnotic techniques in medicine and dentistry. The general use of hypnosis can only develop when the average practitioner realizes that he himself can learn hypnosis, and that no special gifts are required. In medical practice the real problem with hypnosis is in its proper application to treatment, rather than the mere production of the trance itself.

A short chapter only is devoted to the nature of the hypnotic state, presumably on the grounds that as no single theory fits all the observed facts it would be unprofitable to discuss them in detail. The only one mentioned is that of conditioned reflexes, which is capable of explaining a good deal but not all. Dr. Mason's definition of hypnosis as a state of hyper-suggestibility explains nothing, as he himself admits. It is surprising to find, therefore, that he does not refer to the theory that some form of mental dissociation is involved. This has been advanced by many eminent authorities, and it offers a common-sense explanation of most features of the hypnotic state.

Dr. Mason is at his best when describing the phenomena associated with the hypnotic trance and he deals with these at length. Apart from their intrinsic interest, some of them, of course, are of great importance in medical practice, such as the use of post-hypnotic suggestions in general practice, and the employment of regression in psychiatry.

A certain school of medical thought criticizes symptom removal under hypnosis as not affecting a permanent cure, and rejects hypnosis for this reason. One is glad to see that the author's attitude is a common-sense one in this respect. No form of therapy can guarantee a cure; the great merit of hypnotic techniques is that they can be so easily

* *Hypnotism for Medical and Dental Practitioners.* By A. A. MASON, M.B., B.S., Clinical Assistant to the Psychiatric Departments of West London Hospital and King's College Hospital; Director of Studies, Dental and Medical Society for the Study of Hypnosis, etc. With chapters on Hypnosis in Dental Surgery and Obstetrics by K. DAWSON WATTS, F.D.S. R.C.S. (Ed.), and S. D. PERCHARD, M.D. (Lond.), M.R.C.O.G. $8\frac{1}{2} \times 5\frac{1}{2}$ in. Pp. 220, with 8 plates. 1960. London: Secker & Warburg Ltd. 30s.

reapplied. In some cases of inoperable cancer associated with persistent pain relatives can even be trained to give relief. The chief danger is the enthusiast, who may become so obsessed with the use of hypnosis in treating functional disease, that he overlooks organic lesions requiring urgent surgery.

Relieved of the necessity for discussing the nature of hypnosis, its induction, and phenomena, Mr. Watts has managed to cover a good deal of ground in describing the applications of hypnosis in dentistry. He uses the relaxation and eye fixation techniques of induction as a routine, and gives a good orthodox description of the practical techniques and the problems met with in practice. The most interesting part of his chapter is that devoted to the psychosomatic aspect of some dental pain. Training as a dental student is so mechanical that the average practitioner hardly ever realizes that pain or pathological conditions in the mouth can have a psychological background. Two interesting case-histories are quoted which show this possibility. The investigation of cases of this kind presents a difficulty, as patients are not so ready to discuss their domestic and emotional backgrounds with their dentist as they are with their doctor. Such inquiries have to be handled with great tact, and in most cases with the co-operation of the patient's own doctor. Skin diseases are now increasingly being recognized in many cases as an outward manifestation of emotional conflict, and there are good grounds for regarding some mouth disorders in the same light.

Mr. Watts does not comment on two interesting topics, the effect of hypnotic study on the practitioner himself and the reactions of his patient. The practitioner finds he acquires an insight into the psychology of his patients which is of the greatest value in practice. The patient's attitude to hypnotic treatment is best exemplified by the gratitude he invariably expresses; a somewhat rare reaction in dentistry which alone makes the extra effort worth while.

The present writer is not qualified to express an opinion on the obstetric side of this book and can only comment on general grounds. Arguing from common-sense principles it does seem obvious that a physiological process which depends so much on muscular relaxation should benefit from hypnotic techniques. The obstacles appear to be entirely practical. Dr. Perchard shows that they can be overcome in hospital use and there is no reason why, with proper co-operation between doctor and midwife, this cannot be done in general practice. The painless childbirth techniques are hypnotic in conception, although their exponents will not admit the fact. A routine adoption of hypnosis in obstetrics would be of great benefit to thousands of mothers even if it were completely successful with only a percentage.

What light, if any, does this book shed on the future of hypnosis in medicine and dentistry? As has been said, it deliberately understates the possibilities for very good reasons. It emphasizes that hypnosis is an additional, though important, aid to therapy and not a means in itself. The present writer has always felt with hypnosis that the opportunities for its use depend even more on the character and enthusiasm of the practitioner than on the technique itself. Dr. Lieubault as a G.P. in the French town of Nancy in the latter half of the 19th century used it in nearly every case with most conspicuous success.

Practitioners of hypnosis have to contend with prejudices which are centuries old since their inception. They date from the early days when it was jealously guarded by the pagan priesthood, and later thrust underground by the Christian Church. These prejudices have been handed down as a mental inheritance, and it is not surprising, therefore, that these entirely irrational attitudes towards hypnosis are hard to overcome. Until recently, too, there has been an inability to organize groups of practitioners important enough to exert an influence on contemporary thought. One feels now that progress, though it may be slow, will be sure, and that the time will come when instruction in hypnosis will form a part of undergraduate training, and a knowledge of the technique will be regarded as essential to the fully-equipped medical and dental practitioner.

E. E. WOOKEY

LETTERS TO THE EDITOR

September 13, 1960.

Sir,

In a recent issue of the DENTAL PRACTITIONER a leading member of the profession "wonders if there is justification in frequent bite-wing check-ups in children". This is the age group 0–20, using his own classification. May I point out a case which is typical of so many coming to the casualty departments of hospitals?

The patient, aged 17 years, had all fillings completed three weeks previously by his own dental practitioner and subsequently complained of tooth-ache. Clinical

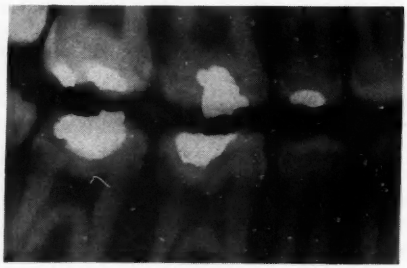

Fig. 1.

examination revealed no apparent caries, and the fillings seen on *Fig.* 1 were all new. The bite-wing X-ray which I took shows seven interproximal cavities. This is a case of irresponsible filling of occlusal cavities without the certainty of X-ray examination. I hope that this type of dentistry is not what the author of the article advocates.

The undue large proportion of X-rays which are of little value are easily dealt with if the Ministry has the courage of its convictions and refuses to pay for them. I feel that every responsible dental surgeon will agree that unsatisfactory work is not worth a fee. The remedy lies with the Ministry, and can only lead to a raising of standards. If there is concrete evidence that some dentists are, to use the unfortunate phrase of the author, "cashing in on the Service", individual action can be taken by the authorities as necessary. Making vague accusations detrimental to the dental profession as a whole could be regarded as irresponsible.

With regard to the question of undue radiation hazard, it is now almost generally accepted that two bite-wings, twice a year, amount to 2 per cent of the natural radiation received by the gonads (Williamson and Williams*)—and could be eliminated altogether by the use of a lead apron.

Yours faithfully,

G. F. KANTOROWICZ

11, *Lansdowne Road,*
Muswell Hill,
*London, N.*10.

* WILLIAMSON, B. D. P., and WILLIAMS, A. B. (1959), *N.Z. dent. J.*, **55**, 180.

September 26, 1960.

Dear Sir,

I must tell you how much I appreciate your editorial in the August issue of the DENTAL PRACTITIONER. I say this not because my name happened to be mentioned, but because you have hit on a most important facet of this whole problem of dental research and education. It has been said that dentistry will move forward only as rapidly as it can assimilate the knowledge now existing in the basic sciences, and I am sure this is close to the truth. One aspect of the problem which you did not mention, but which also plays a role, is not only the importance of utilizing people with a basic science background but also to *interest* these people in dental application. Too often they are never approached in regard to the importance of their research to dentistry or to acquaint them with the dental application.

At any rate, the editorial was refreshing and I would also like to compliment you on the high standards you are establishing in this journal.

Sincerely yours,

R. W. PHILLIPS
(Chairman and Professor)

Department of Dental Materials,
School of Dentistry,
Indiana University,
Indiana, U.S.A.

September 22, 1960.

Dear Sir,

In your August editorial you rightly stress the need to extend the boundaries of dental research. I would like to make a plea for the introduction of research projects, and a much deeper interest in research at the undergraduate level of dental education. Many a postgraduate worker has come to regret his almost complete lack of training in even the elements of research when he finds he has to return to basic principles. It is here that the so-called basic sciences should play their primary role in dental education. Even for a student aiming for a life in general practice, such a training could be of infinite value. It would enable him to keep abreast of current advances, to evaluate the literature, and obtain a deeper and more satisfying interest in his profession. In its essence, research is an attitude of mind, without which any dentist is only partly educated.

Yours sincerely,

JAMES SCOTT

Department of Anatomy,
The Queen's University of Belfast.

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ASPECTS OF THE TRANSITION FROM THE DECIDUOUS TO THE PERMANENT DENTITION*

PART II

By **EILEEN M. E. BONNAR**, L.D.S., D.D.O.
Department of Orthodontics, Royal Victoria Hospital, Belfast

IN PART I of my paper "Aspects of the Transition from Deciduous to Permanent Incisors" (*Trans. Brit. Soc. Orthodont.*, 1956, 41) I dealt exclusively with changes in the occlusal relationships of the buccal segments. In this second part of the paper I wish to deal with other developmental incidents noted in the same children and have grouped them under the following headings:—

1. Angular relationships of the upper and lower permanent incisors at various stages of development showing:—

a. Independent "positioning" of the upper and lower incisors.

b. Change of direction of eruption of the upper permanent incisors.

2. Discrepancy between upper and lower centres in the deciduous and permanent dentitions.

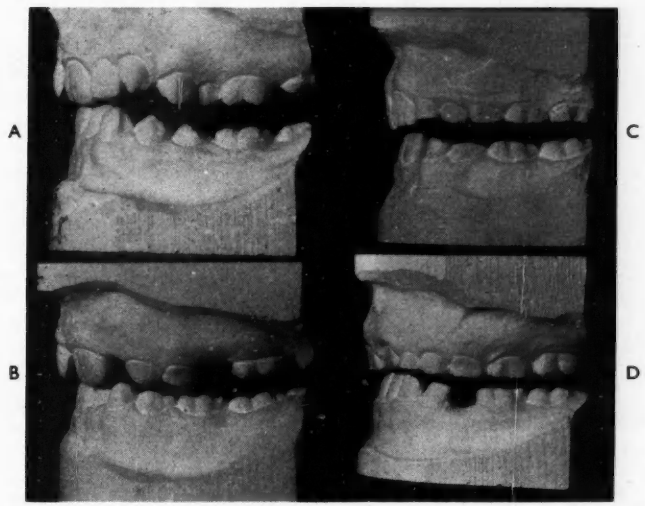

Fig. 1.—Cases showing independent positioning of the upper and lower permanent incisors. A, Typical example in permanent dentition, potentially normal occlusion. Upper and lower incisors lingually inclined, bite very close. B, The lingual inclinations of the central incisors of A during eruption. (Models separated by rubber band because of very close bite.) C, Different case of normal occlusion. Earlier stage before the upper and lower permanent incisors make contact (normal occlusion). D, Post-normal occlusion showing very early lingual tilting of both upper and lower permanent incisors.

3. Attrition and forward movement of the lower arch.

4. Rotations of the upper and lower incisors in the deciduous and permanent dentitions and their relationship to lack of space.

5. One non-standard mode of upper permanent lateral incisor eruption.

6. Relationship between spacing (or lack of it) of the deciduous incisors, increases of the intercanine width, and alinement of the permanent incisors.

* Part I of this paper appeared in the 1956 *Transactions* and in the *Dental Practitioner*, 1956, **7**, 42.

Given at the meeting held on March 14, 1960.

1. ANGULAR RELATIONSHIPS OF THE UPPER AND LOWER PERMANENT INCISORS AT VARIOUS STAGES OF DEVELOPMENT

***a.* Independent "Positioning" of the Upper and Lower Permanent Incisors.**—In the introduction to Part I it was stated that malocclusions are most commonly seen when the full upper/lower relationship between the permanent incisors has been established. The closeness of that relationship created the impression that the malocclusions were due to the interaction of the two groups. For example a frequent type of malocclusion is one in which there is a lingual inclination of both upper and lower permanent incisors, with increased incisal overbite. What are the factors responsible for this end-result? Is it because the lower incisors, which, as a rule erupt first, have a lingual tilt from a very early stage and therefore do not give the necessary support to the upper incisors? The latter, which may have been erupting normally, then "collapse" lingually also, until contact with the lower incisors is established. Or, in these cases, could it have been the upper incisors which erupted first with a lingual inclination and thus prevented the lower incisors from coming forward into a normal position?

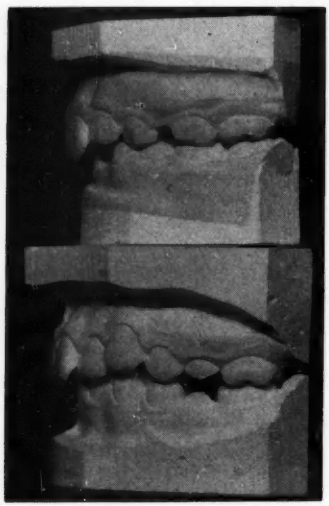

Fig. 2.—Change in direction of eruption. A, The upper permanent central incisors very vertical on eruption, lower incisors lingually inclined and imbricated. Bite close. B, Same case as in (A) approximately two years later. Considerable labial inclination of both upper and lower incisors, with some reduction of the overbite.

From the evidence here presented there is what I have termed "independent positioning of the upper and lower permanent incisors". It is seen from the models (*Fig.* 1) that the lingual inclination is present from the first appearance of the teeth, so that the relationship is established by continuing eruption on the initial path. It is not a matter of the upper incisors collapsing on the lowers, or of the lower incisors being held back by the lingual inclination of the uppers.

In most of these cases after the upper and lower permanent incisors do make contact there is no change in the relative inclination of either, but both may become even more lingually inclined or slightly more labially. This incisal relationship occurs where the anteroposterior relationship of the lower to upper arch is either normal or post-normal.

It is known, however, that should the normal relationship established between the upper and lower permanent arches be upset by the loss of a tooth, or teeth, from either arch, there may be repercussions in the unbroken arch. Often the upper permanent incisors incline lingually following the loss of a lower permanent molar (one incisor, generally a lateral, being excluded from the arch labially).

This is a secondary condition and quite different from the primary condition under consideration.

Also, it must not be presumed that there never is any interaction between erupting and erupted permanent incisors. Cases are well known where individual incisors, either upper or lower, which have erupted in a labial or lingual position, are the means of forcing their opponents into abnormal positions.

***b.* Change in Direction of Eruption of Permanent Upper Incisors.**—Friel (1927) has shown that one of the ways by which the larger permanent upper incisors are accommodated in the arch is by their being more labially

inclined. These models (*Figs.* 2–4) show that in a considerable number of cases (more than 50 per cent) this labial inclination of the upper permanent incisors is acquired after the crown has been erupting in a vertical direction, sometimes even in a lingual direction. It is not necessarily a continuous growth in a labial direction from the first appearance of the crown. This change in the direction of eruption is most clearly seen in those cases where, had it not occurred, the upper permanent incisors would have occluded lingually to the lower incisors. In most of the cases where it occurs, it is of such a degree that it can easily be seen before taking measurements. There were no habits or abnormal muscle patterns that could be detected in these cases which would account for this labial tilting.

As the tables show, the labial inclination of the upper incisors, when fully erupted, may be:—

i. The same as during the process of eruption —unchanged from the first appearance of the crown.

ii. Acquired during eruption from original lingual inclinations.

iii. Acquired during eruption from original vertical positions.

iv. Acquired during eruption from original labial inclinations.

The only other reference to this aspect of incisal eruption is by Baume (1950). He says that the upper incisors are guided into position by the lower incisors, the latter having erupted first.

The models both in this group and in the previous one show that it is not a matter of

Table I.—Dealing with the Labial Inclinations of the Upper Permanent Central Incisors, and showing how it Changes or not, as the Teeth Erupt

Belfast Models
(Total, 50)

A

1. Number where $\underline{1|1}$ erupt lingually inclined — 14 → 3 Do not change; 10 Tilt labially → 5 Where $\underline{1|1}$ only reach vertical positions, 5 Where $\underline{1|1}$ become labially inclined; 1 (No final models)

2. Number where $\underline{1|1}$ erupt vertically — 21 (18 B/L, 3 U/L) → 3 Do not change; 17 Tilt labially → 14 Very definite, $\underline{1|1}$ labially inclined, 3 Slight movement only; 1 Tilts lingually

3. Number where $\underline{1|1}$ erupt with labial inclination — 17 (13 B/L, 4 U/L) → 5 No change; 10 Tilt labially → 9 Very definite, 1 Only slightly; 1 ? change; 1 (Only one)

4. Total number where the labial inclination increases from 1, 2, or 3 — 36 (34 B/L, 2 U/L) → 10 From Group 1, 17 From Group 2, 9 From Group 3

5. Number where $\underline{1|1}$ became more lingually inclined — 1 Slight lingual movement from 1 in Group 2 after $\underline{1|1}$ had tilted labially

Therefore labial inclination of $\underline{1|1}$ increases in 34 cases out of 50, i.e., 68 per cent.
In 39 cases where $\underline{1|1}$ are labially inclined in the end:—
17 Erupt with a labial inclination (increased in 10)
17 Have changed from original vertical position
5 Have changed from original lingual inclination

B

No change at all in:— 11 Cases (3 From Group 1, 3 From Group 2, 5 From Group 3) 12 per cent

i.e., in 12 per cent the original lingual or vertical relationship of $\underline{1|1}$ to occlusal plane remains throughout.

B/L = Bilateral; U/L = Unilateral.

the upper incisors coming into contact with the lower incisors and then being forced one way or the other along a sliding plane. They may be vertically, lingually, or labially inclined on eruption, and continue in these directions, or become more labially or more lingually inclined *before* they come into contact with the lower incisors (*Figs.* 1–3).

Only if one has been fortunate enough to have frequent models of children's dentitions during the period of eruption of the incisors former and 59·5 per cent of the latter. (*See Tables I* and *II.*) The occlusion in most of these cases is normal, but in a few it is post-normal on one or both sides and in one it is pre-normal.

Only the behaviour of permanent upper central incisors has been dealt with in detail and measured for the purposes of this paper, but it was observed that the labial inclination of the permanent upper lateral incisors and of the permanent lower incisors does become increased also (*Figs.* 2, 3).

Table II.—Dealing with the Labial Inclinations of the Upper Permanent Central Incisors, and showing how it Changes or not, as the Teeth Erupt

London Models
(Total, 47)

1. Number where $\underline{1|1}$ erupt with lingual inclination — 12:
   - 2 No change
   - 10 Tilt labially → 5 Definite movement → 2 Where $\underline{1|1}$ become labially inclined; 3 Where $\underline{1|1}$ still only vertical
   - 10 Tilt labially → 5 Only slight movement

2. Number where $\underline{1|1}$ erupt vertically — 18:
   - 4 Do not change
   - 12 Tilt labially → 10 Where $\underline{1|1}$ become definitely labially inclined; 2 Only very little labial movement, $\underline{1|1}$ still approximately vertical
   - 2 Only one model

3. Number where $\underline{1|1}$ erupt labially inclined — 22:
   - 10 No change
   - 6 Move labially
   - 4 Less labially
   - 2 Only one model

4. Total number where $\underline{1|1}$ become more labially inclined from 1, 2, or 3 — 28: 25 Considerable, 3 Very slight inclination → 10 From Group 1; 12 From Group 2; 6 From Group 3

5. Number where $\underline{1|1}$ become more lingually inclined — 4 From Group 3 (all very slight degree)

Therefore labial inclination of $\underline{1|1}$ increases in 28 out of 47 cases, i.e., 59·5 per cent.
In 34 cases where $\underline{1|1}$ are labially inclined in the end:—
22 Erupt with a labial inclination (increased in 6)
10 Have changed from original vertical positions
2 Have changed from original lingual inclination

No change at all in:— 16: 10 From Group 3; 4 From Group 2; 2 From Group 1 — 12·76 per cent

i.e., in 12·76 per cent the original lingual or vertical relationship of $\underline{1|1}$ to occlusal plane remains throughout.

can this change of direction be detected. It can be shown in degrees by measuring the angle of the labial surface of the upper permanent incisors and the occlusal plane at the various stages of eruption. This angle was measured on 50 Belfast models and on 47 of Miss Clinch's London models. It was found that the labial inclination of the permanent upper central incisors increased in 68 per cent of the

2. DISCREPANCY BETWEEN UPPER AND LOWER CENTRES IN DECIDUOUS AND PERMANENT DENTITIONS

In a surprising number of the deciduous dentitions it was noted that the upper and lower centres do not correspond with one another. Using the median palatine raphe as a guide, it is seen that in most cases the fault is in the lower arch. In the small number of cases

where the upper centre is definitely off, it was generally found that there was a sucking habit, and so they were not included. In a few, also, the upper centre is to one side and the lower centre to the opposite side. There is also a small number where it is very difficult to be sure which centre is at fault using simple means, so in order to simplify the results I have, in all cases, charted the relationship of the lower centre to the upper centre and not the relationship of either to the median palatine raphe.

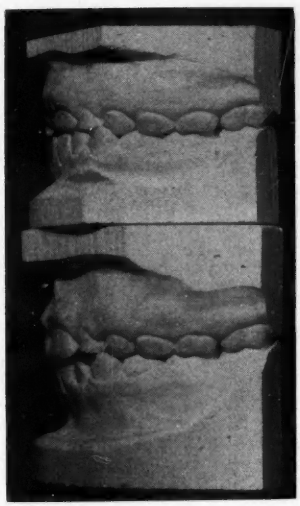

Fig. 3.—Earlier stage. A, The upper permanent central incisor partially erupted and slightly lingual to the lower central incisor. B, Same case a few months later, before the upper and lower incisors make contact.

This discrepancy in the centres is of very early origin, seen in the earliest models and in one child at 12 months. It seems extremely probable that it was present at the time of eruption of the incisors. Once established it is carried right through the change-over period and appears to be approximately the same degree in the permanent dentition in the majority of cases. There was no reduction of either arch in any of these particular cases.

Asymmetry of the centre may, of course, be influenced by any premature extraction of teeth in either arch, especially in the lower (*Fig.* 8).

If the extracted teeth are permanent ones, and especially if these are lost at an early age, there is a definite and permanent effect on the relationship of the upper and lower centres. For example, if the lower centre had been off to the left originally, it will move to the right of the upper centre on the loss of a permanent tooth in the lower right buccal segment. The nearer to the centre the extraction takes place, the greater the deviation of the centre.

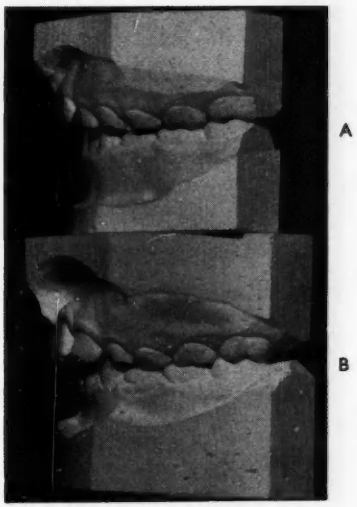

Fig. 4.—A, The upper permanent central incisors erupting very vertically, but considerably labial to the lower incisors. B, Same case when the permanent upper laterals have erupted.

With early loss of the deciduous teeth, however, the picture is somewhat different, depending on which teeth are extracted, the age, and whether or not there is crowding of the teeth. If a canine or molar, particularly a first molar, is lost in a crowded arch at an early age, it is almost certain to result in a deviation of the centre to that side.

Where there is premature loss of one or more lower deciduous incisors, the position of the lower centre may change, but this change is often only a temporary one. The original relationship of the centres may be established

on the full eruption of the lower permanent incisors. The position of the lower centre can also vary a bit as the lower permanent incisors are erupting (*Fig.* 9), particularly where there is some initial lack of space, though it is also seen to occur where there is no crowding. It does, however, revert to the original central position on full eruption of the lower permanent incisors, if it was central in the deciduous dentition.

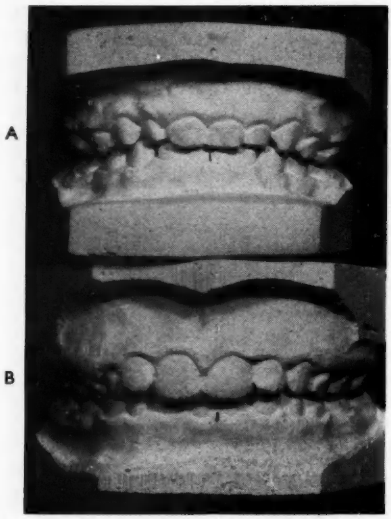

Fig. 5.—A, Lower centre to the left of upper centre at 3½ years. B, Same case at 8½ years.

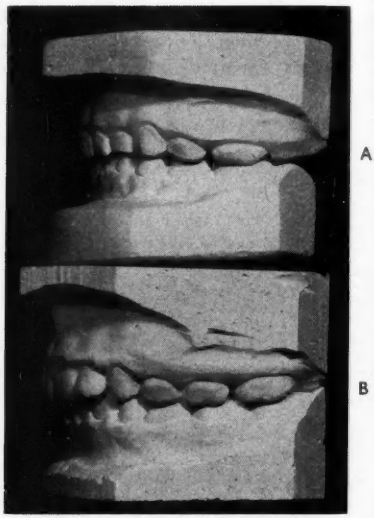

Fig. 6.—Left side of *Fig.* 5. A, at 3½ years. B, At 8½ years. *Note* the post-normal relationship of lower arch, before and after the eruption of the first permanent molars.

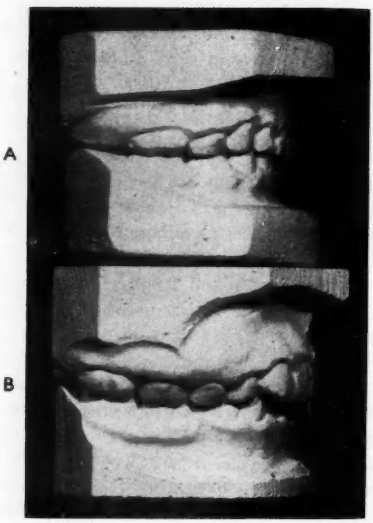

Fig. 7.—Occlusion of *Fig.* 5 on right side. A, At 3½ years. B, At 8½ years. *Note* the forward movement of lower arch and normal occlusion of the first permanent molars.

It should be noted that where the upper arch is narrow and a bite of convenience established, the relationship of the upper/lower centres can change according to the teeth erupted. These cases are not included in this study.

In no instance, in the Belfast cases, where the discrepancy is present in the deciduous dentition is it absent in the permanent dentition though it may be of lesser degree. However, this did happen in one of the London models (1 per cent), so that contrary to what I had concluded, it is possible for the discrepancy to be corrected (though not probable). In this one case, the lower centre was off to the left at 3½ years. There was a distal relationship of the lower left buccal segment to the upper, while on the right side the lower buccal segment was in a forward relationship to the upper. Then, in the deciduous dentition,

a dramatic change took place, the lower left buccal segment moved forward until, at the time of eruption of the first permanent molars, the distal surface of the lower second deciduous molar was anterior to that of the upper corresponding tooth, and the upper and lower centres came to correspond. No forward movement on the lower right side took place, but there was a slight reduction of the overbite. There were no spaces at any time between the deciduous teeth.

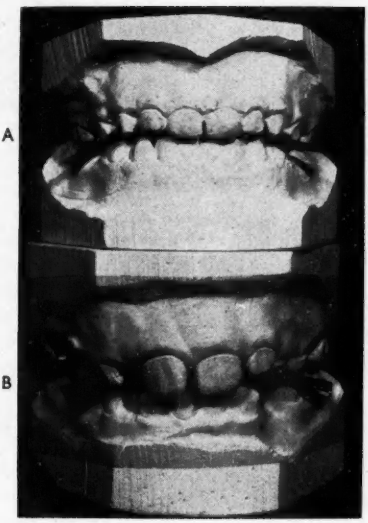

Fig. 8.—A, Lower centre to the right at 3½ years. There was early loss of the lower left first molar. B, The lower centre well off to the left when the upper and lower permanent incisors erupt. It remained there.

There is a marked association between discrepancy of the centres and a distal relationship of the lower buccal segment on the side to which the lower centre is deflected (*see Tables*). These, in conjunction with the sequence of events in the above case, would indicate that a cause of the discrepancy in the centres is a very early lack of forward growth of one lower buccal segment (*Table III*).

It is interesting to note that in one (Belfast) case (*Figs.* 10, 11), where the lower buccal segment made up for this initial lack of forward growth at a late stage (after $\overline{2|2}$ had erupted) so that the arch relationship became normal, the discrepancy in the centres was still present, though to a lesser degree. It would appear

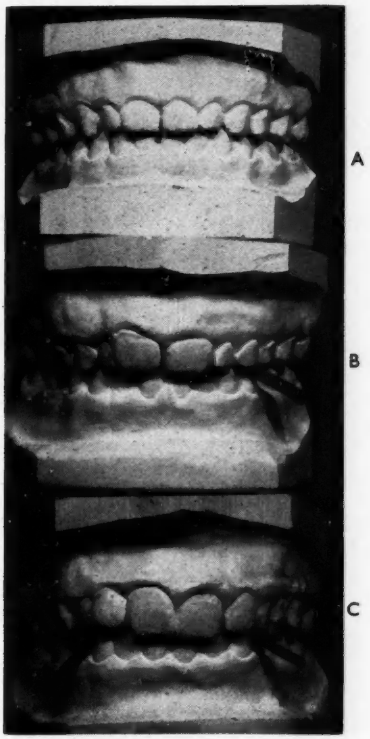

Fig. 9.—A, The lower centre to the right of upper centre in the deciduous dentition. B, Lower centre to the left now when the permanent lower centrals have erupted, but before the lower left lateral incisor has fully erupted. C, The lower centre over to the right again when the lower left lateral has erupted.

that only when forward movement of the lower buccal segment takes place at an early stage—before the lower permanent incisors are fully erupted—is it likely that the original discrepancy in the centres will be corrected.

Reference was made to this subject by Delabarre in 1819. He examined 338 children under 7 years of age and found there was a deviation of the incisal median planes in 44·6 per cent.

He concluded, "Deviation of the incisal medial lines is more than an occasional indication,

and because of the serious maldevelopment that may follow, and the consequent technical difficulty of reduction, it should be given a place of more importance in diagnosis".

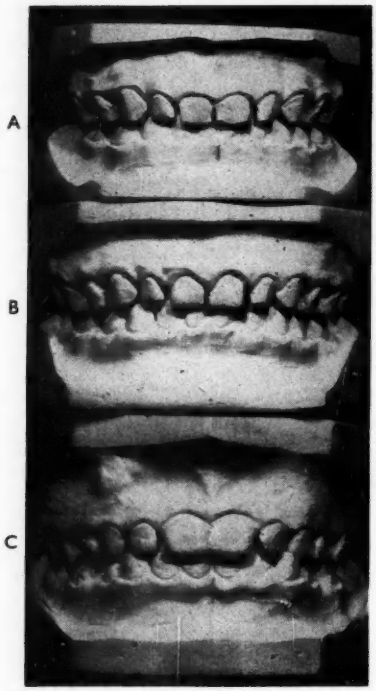

Fig. 10.—A, Case before first permanent molar has erupted showing lower centre deflected to the left, frontal, and left occlusal views. B, After it has erupted. C, The lower centre is still to the left even though the lower left buccal segment had moved forward into normal occlusion. *Note* both show the lower centre to the left of upper centre. Note the increased spacing (particularly in the lower) of the deciduous incisors in (B).

3. ATTRITION AND FORWARD MOVEMENT OF THE LOWER ARCH

The relationship between attrition of the deciduous teeth and forward movement of the lower arch has never been established. Looking at the normal deciduous dentition in occlusion one concludes naturally that unless there is attrition of the canines and incisors at any rate, no more forward relationship of lower arch to upper can be established.

Observing that in many deciduous dentitions incisors and canines do become worn down, one is tempted to infer that any more forward relationship of lower arch is "due to" attrition.

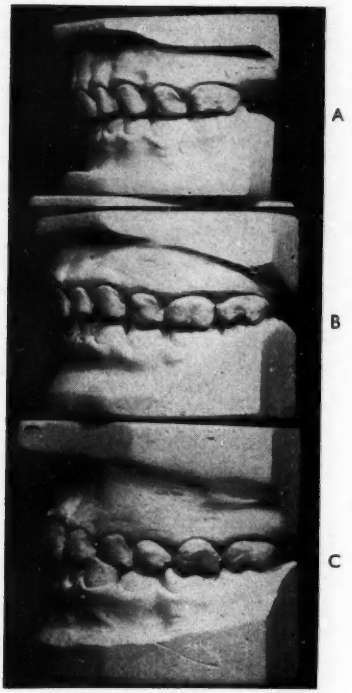

Fig. 11.—A, Same case as *Fig.* 10. B, *Note* the distal relationship of the lower arch on the left side. C, After eruption of permanent incisor. The lower arch has moved so far forward that the first permanent molars now occlude normally.

My observations on the children recorded seem to disprove both conclusions and to leave the nature of the relationship much more obscure (Bonnar, 1956).

In Part I of this paper (1956) it was shown that forward movement of the lower arch is not confined to one period, but can take place at different stages, and also that the forward relationship of the lower arch can be present from the first appearance of the teeth.

There is no simple correlation between attrition and forward movement of the lower arch. It is usual for attrition of the deciduous

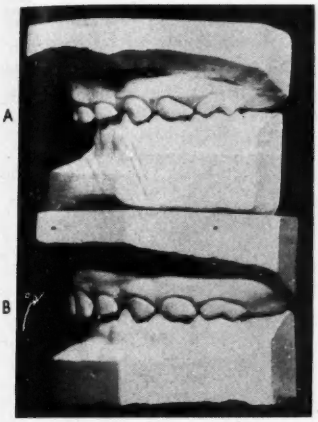

Fig. 12.—Attrition. **A**, Left occlusal view. The lower arch well forward at 3½ years, yet no attrition of the deciduous canines. **B**, Eight months later. The lower arch has moved further forward, yet no attrition of the deciduous canines is visible.

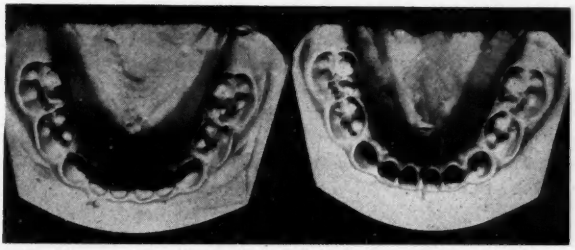

Fig. 13.—Attrition. Occlusal views of the lower arch of case in *Fig.* 12 showing the sharp cusps of the deciduous canines and molars.

teeth to take place, but there is great variation both in the amount and in the rate at which it takes place. Some of the deciduous teeth are found to be well worn down shortly after the deciduous dentition is completed, in others there is very little wear by the time they are due to be shed.

As the tables show, it does not follow that in the former the lower arch has moved forward, while in the latter cases no forward movement has taken place. Quite often in those instances where the lower arch is, at 3½ years, in the forward relation to the upper arch, which was not previously thought to be established until around 6 years, there is very little, or no, attrition of the teeth (*Figs.* 12, 13).

On the other hand, in many cases there has been so much attrition that the molar occlusal surfaces are worn quite flat, yet the lower arch

Table III.—Discrepancy between the Upper and Lower Centres in the Deciduous and Permanent Dentitions, and its Association with the Anteroposterior Relationship of the Upper and Lower Arches

Belfast Models

(Total, 52—44 only counted. No teeth extracted in either arch.)

Discrepancy in U/L centres in deciduous dentition and permanent dentition found in:—

25 { 15 Lower centre ——→ R. / 10 Lower centre ——→ L. } 56·8 per cent

In 23—Lower arch was in a more distal relationship to the upper on one side to which lower centre is deflected.

U/L centres corresponded in deciduous dentition and permanent dentition in 19 cases.

In 1 of these there is a difference in relationship U/L arch on one side.

London Models

(Total, 43)

Discrepancy in U/L centres in deciduous dentition found in:—

18 { 9 Lower centre ——→ R. / 9 Lower centre ——→ L. } 40·86 per cent

Corrected in 1 case in permanent dentition, i.e., { Lower centre ——→ lower in deciduous dentition / U/L centres corresponded in permanent dentition }

In 14 of these 18 cases the lower arch was in a more distal relationship/upper on side to which lower centre is deflected.

In 2—Very slight discrepancy and no detectable difference in the arch relationships.

In 1—No spacing $\overline{d\text{–}e|}$ on the side off-centre, spacing $|\overline{e\text{–}d}$, but end arch relationship same on both sides.

In 1—Lower in Class III relationship and no detectable difference in either side.

U/L centres corresponded in deciduous dentition and permanent dentition in:—

25 cases and of these in

9 there is a more distal relationship L/U on one side.

has not changed its relationship to the upper arch (*Figs.* 14, 15).

In individual cases, also, there is not an even rate of attrition. In one period of six months or a year there may be no apparent wear of the deciduous teeth, but in the succeeding similar period, a great deal. These periods, that could be termed "active" and "non-active" as regards attrition, do not coincide with the periods of movement or stationary relationship of the lower arch, as

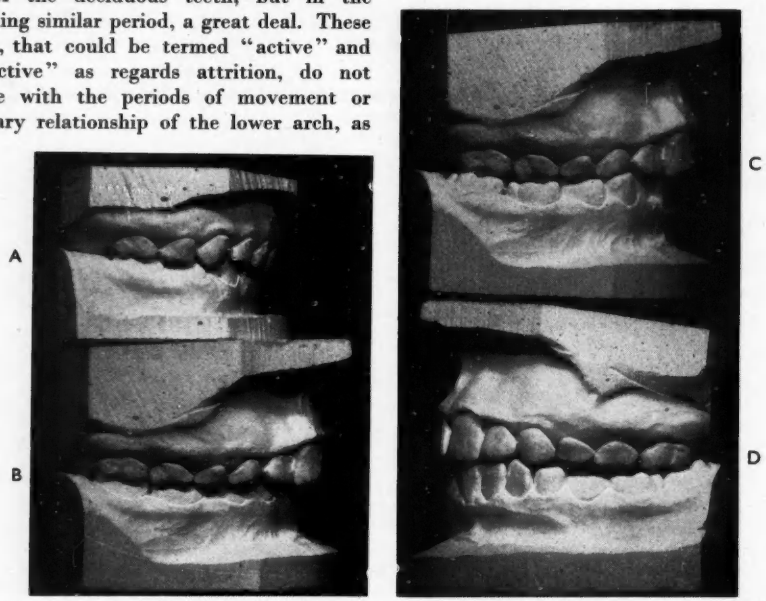

Fig. 14.—Attrition. A, Shows occlusion of the right upper and lower buccal segments at 5½ years. B, Same case at 8½ years. Considerable attrition of the deciduous canines yet negligible forward movement of lower arch. C, Same case. The relationship of the buccal segments on the right side during the movement of the lower jaw to the right. *Note* how the attrition has occurred on the medial surface of the tip of the upper canine and on the distal surface of that of the lower incisor. D, Same case. Left side, showing the relationship of the upper and lower buccal segments during the movement of the lower jaw to the left. (As the lower centre was off to the left, the lower left buccal segment was distal to the upper left buccal segment on closure.) *Note* how the attrition of the upper deciduous canine on this side is on the distal mesial surface, while that of the lower deciduous canine has taken place on the medial mesial surface. (Compare with C.)

would be expected if attrition was a vital factor in forward movement of the lower arch. If the facets on the upper and lower teeth, caused by attrition, are examined, it will be seen that in many cases the lateral movements of the lower jaw are more closely connected with attrition than forward movement (*Figs.* 14 C, D, 15 B). Therefore, although it seemed logical to presume that if no attrition of the deciduous teeth takes place, there could be no forward movement of the lower arch, these models show that in reality such conclusions cannot be drawn. Whether or not this forward movement takes place depends on other factors, chief of which seems to be some inherent force which can even overcome adverse environmental conditions such as lack of attrition (*Table IV*).

(Baume, 1950, found that function and wear of teeth had little influence on the establishment of a normal molar occlusion.)

4. ROTATIONS OF THE UPPER AND LOWER INCISORS IN THE DECIDUOUS AND PERMANENT DENTITIONS AND THEIR RELATIONS TO LACK OF SPACE

Rotations of the deciduous incisors are quite common, though generally they are of slight degree only. In these models, rotations of the lower deciduous incisors occur more frequently than rotations of the upper deciduous incisors.

There is a closer association between lack of space and rotations of the deciduous incisors in the lower arch than in the upper arch. In the latter there was spacing in 50 per cent of the cases of rotated incisors, crowding in 33·3 per cent, and close incisal contacts in 16·6 per cent; while in the lower arch there was spacing in 30 per cent, crowding in 40 per cent, and close incisal contacts in 30 per cent.

There is no correlation between rotation of the deciduous incisors and rotation of the permanent incisors. As the permanent incisors go through a stage of crowding before eruption starts, many adapt themselves to lack of space at that stage by rotation. After eruption the crowding may still exist, in which case the rotations remain much as on the first appearance of the tooth, but even though there is adequate space the incisors remain rotated in many instances.

Here the upper and lower permanent incisors differ somewhat. As can be seen from the following tables, rotations of the lower permanent incisors are mostly found where there is lack of space for even alinement of all the teeth (*Figs.* 17, 18) (i.e., in 78 per cent, compared with 36 per cent in upper), while in the upper the reverse is true. In the majority of the cases of rotated upper permanent incisors (64 per cent) there is ample, if not more than enough, space available (*Fig.* 16).

In the lower there was self-correction of the rotation in 56 per cent of cases (50 per cent complete, 50 per cent partial), while in the upper the equivalent percentage was only 18·2 per cent. There was no self-correction at all of the rotations in 72·7 per cent of the upper cases, compared with 37·5 per cent of the lower cases.

If one took permanent incisors as an overall class one would be led to conclude that the chances of self-correction occurring are very much less in originally "spaced" conditions,

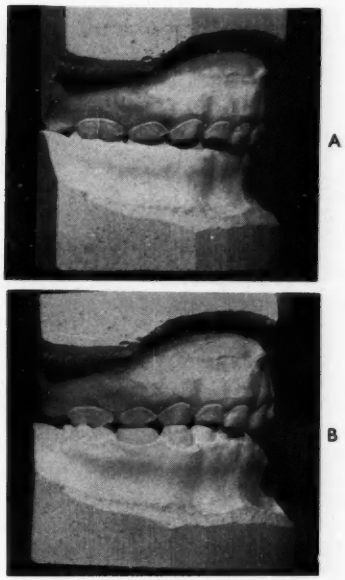

Fig. 15.—Attrition. A, Considerable attrition of the deciduous canines associated with a distal relationship of the lower arch. B, Same case showing the movement of the lower jaw to the right. *Note* how the attrition facets on the deciduous canines correspond with the contact surfaces on lateral movement.

Table IV.—The Association between Attrition of the Deciduous Teeth and the Anteroposterior Relationship of the Upper and Lower Arches

(Total, 47)

Forward relation of lower/upper arch from very early stage:—

In 18 cases { No attrition in 5; Very slight degree attrition in 6; Considerable attrition in 7 }

Where lower arch had moved forward in relation to upper arch:—

In 23 { 14 B/L; 9 U/L } { No attrition in 7; Very slight degree attrition in 8; Considerable attrition in 8 } 16 Attrition plus forward movement

Where lower arch did not move forward at all in relation to upper arch:—

In 13 { No attrition in 0; Slight attrition in 4; Considerable attrition in 9 } 13 Attrition and no forward movement

than in originally crowded conditions. Detailed examination of the cases, however, reveals that this is true only as regards upper permanent incisors. In the lower arch, though crowding is almost four times more commonly found associated with rotations than spacing, the proportion of self-corrected rotations in each condition is approximately the same, i.e., full

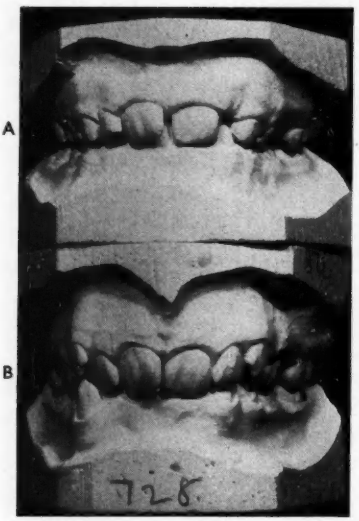

Fig. 16.—A, Rotation of the upper right permanent incisor during eruption. B, Four years later. Plenty of space from beginning, but no self-correction.

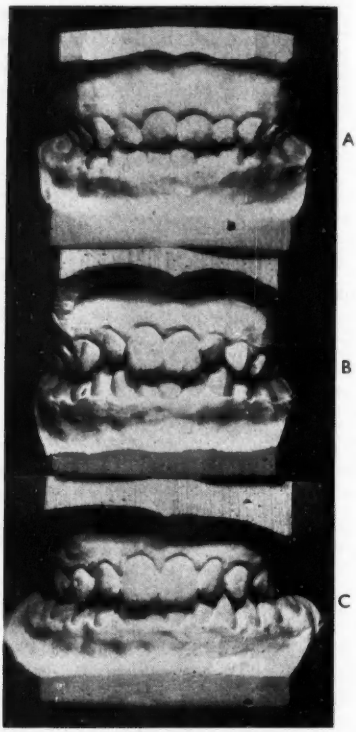

Fig. 17.—A, Rotation of the upper right permanent central incisors and lower right lateral—insufficient space. B, Eighteen months later, the upper and lower intercanine width has increased and the rotation of the upper right central and lower right lateral incisors are partially corrected. Now the upper laterals are erupting, short of space and isolated. C, Eighteen months later. Shows almost complete correction of the upper and lower rotations. Increase of intercanine widths and also increased labial inclination of both upper and lower permanent incisors.

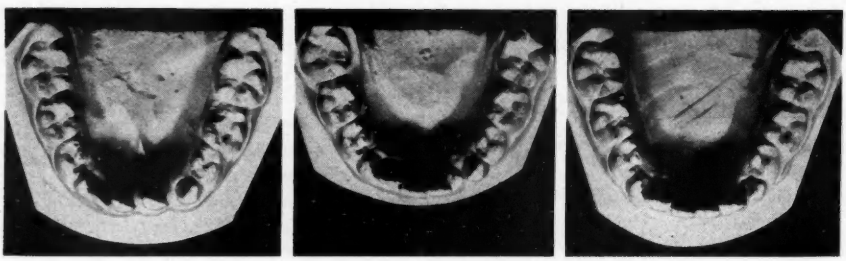

Fig. 18.—A, Occlusal views of lower arch of another case, showing rotation of the left permanent central incisor on eruption and spacing. B, Permanent laterals erupting, rotation of central now corrected, but left lateral now rotated, very short of space. C, Six months later. Increase of the intercanine width and correction of the rotations almost complete.

correction in 28 per cent. In the upper where there was spacing, there was full correction in only 7 per cent, whereas in crowded conditions the percentage was 25 per cent (*Figs.* 16–18 and *Table V*).

It has been found that the greatest increase in the intercanine width takes place just prior to and during the eruption of the permanent incisors, upper and lower (*see* Sect. 1*b*). Therefore in the majority of cases, as the permanent incisors are erupting, the space available is increasing and a great many of them, which are rotated on first appearing, particularly lowers, become corrected as they erupt. This was noted by Baume (1950), who stated that the strongest growth impulse in the mandible was during the eruption of the permanent second incisors, and first incisors which were rotated slightly became straightened when the laterals erupted.

Besides this increase of the intercanine width there is also, as described in Section 1, (*b*) of this paper, a tendency in many cases for the upper and lower incisors to become more labially inclined as they erupt. This labial tilting, or inclining, has an important bearing on rotations also (*Fig.* 17). In a few cases, both upper and lower, where there was no increase of the intercanine width, yet the rotations were corrected, it was found that the incisors had inclined labially sufficiently to give the space necessary for even alinement of all the teeth.

It would therefore appear that rotations of the permanent incisors can be separated, to begin with, into two groups.

i. Those due to lack of space, not only at the time of eruption, but subsequently.

ii. Those of very early pre-eruption origin, independent of spacing.

These latter do not become corrected, though ample space is available during the whole eruption period (*Fig.* 16).

Table V.—The Relation between Rotations of the Upper and Lower Permanent Incisors and Sufficient or Insufficient Spaces

Belfast Models

(Total, 47)

Rotation of upper permanent incisors in 22 instances (22 models)	
Rotation of lower permanent incisors in 32 instances (25 models)	
Ample space for upper permanent incisors in 64 per cent	
Ample space for lower permanent incisors in 21·9 per cent	
(Therefore lack of space for upper permanent incisors in 36 per cent)	
(Therefore lack of space for lower permanent incisors in 78·1 per cent)	
Complete correction of rotated upper permanent incisors in 13·63 per cent	
Complete correction of rotated lower permanent incisors in 28·35 per cent	
Partial correction of rotated upper permanent incisors in 4·6 per cent	
Partial correction of rotated lower permanent incisors in 27·9 per cent	
No chance of correction at all of upper permanent incisors in 72·7 per cent	
No chance of correction at all of lower permanent incisors in 37·5 per cent	

Most of the rotations of the lower permanent incisors belong to Group 1, while the majority of rotations of the upper permanent incisors are in Group 2.

The proportions of self-corrections of rotations is very much greater in the case of lower permanent incisors than of upper permanent incisors, though there is no association between spacing and lack of self-correction in the lower, as is found in the case of upper permanent incisors.

5. ONE NON-STANDARD PATH OF ERUPTION OF THE UPPER PERMANENT LATERAL INCISOR

Quite often patients are referred to the orthodontist when the permanent upper lateral incisors are erupting or have just erupted, because, instead of these teeth being placed in an even alinement between the permanent central incisors and the deciduous canines, they are tilted somewhat distally, their distolingual surfaces overlapping the mediolabial surface of the deciduous canines.

In many of these cases there is a slight shortage of space and the distal tilt of the upper laterals appears to be due to a lag in growth in width of the maxilla at the apical level. Broadbent (1941) has recorded this in frontal

radiographs. It can also occur where there is spacing between the incisor crowns.

The temptation is to advise expansion of the upper arch or extraction of the deciduous canines where there is some crowding. In an earlier survey of 390 primary schoolchildren in Belfast this relationship of the permanent upper laterals was noted in 150. In the present study, and also in Miss Clinch's series, it occurred in 20 per cent.

No treatment was carried out and when the permanent canines had erupted the central incisors, lateral incisors, and canines were all in normal alinement. The original relationship of the lateral incisor was a temporary one, and should be regarded as being within the range of the normal at that age (*Fig.* 19).

6. RELATIONSHIP BETWEEN SPACING (OR LACK OF IT) OF THE DECIDUOUS INCISORS, ALINEMENT OF THE PERMANENT INCISORS, AND INCREASES OF THE INTERCANINE WIDTH

This is one aspect of the development of the occlusion which has received the attention of practically every investigator who has collected, or had access to, a series of models.

There is fairly general agreement that the greatest increases in the breadth of the dental arches takes place in the intercanine distances, that these increases are greater in the maxilla than in the mandible, and that the greatest mean increase in both arches takes place around the time of eruption of the permanent incisors (Colyer, 1920; Lewis and Lehman, 1929; Korkhaus, 1932; Chapman, 1935; Cohen, 1940; Baume, 1950; Clinch, 1951; Barrow and White, 1952; Burson, 1952).

Their conclusions, however, differ with regard to what precedes and follows this increase in the intercanine measurement during the eruption of the permanent incisors. Lewis (1932), Chapman (1935), Baume (1950), Sillman (1948), Barrow and White (1952) found that there was no (or negligible) increase in this measurement between the ages of 2 and 6 years, while Clinch (1951) noted a small increase in both arches before the eruption of the permanent incisors, and Woods (1950) a gradual increase in the upper intercanine measurements, except for a decrease between the ages of 7 and 12 years.

Moorrees (1959) states that in the maxillary arch the increase in breadth takes place during

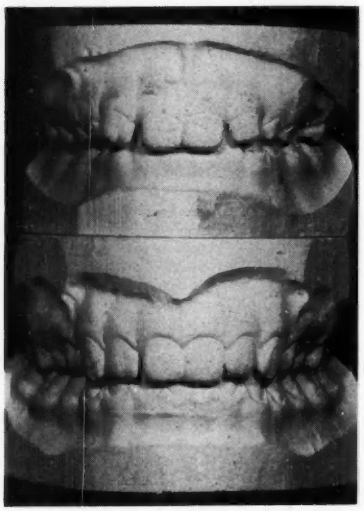

Fig. 19.—A, Upper permanent lateral incisors erupting, tilted distally, spaced from the central incisors. B, Same case when the permanent canines have erupted. Upper laterals now in even alinement.

three phases, each followed by a period during which little change occurs, i.e., (*a*) 3–4 years, (*b*) 5–6 years, (*c*) just before emergence of the permanent canines. After the third phase, the width decreases slightly but definitely until 18 years of age. In the mandible the mean distance between the canines increases continuously and markedly after 5 years of age to a maximum at 10 years of age in males, and 9 years of age in females. Following this growth phase, around the mean age of emergence of the permanent mandibular canines, there is a slight decrease in the average intercanine distance. Little change occurs after the age of 12.

Lewis observed that after the spurt of growth during the eruption of the permanent incisors, there was no increase in the intercanine measurements from 9–10½ years of age. This was then followed by another growth spurt, reaching its maximum at the age of 13. Clinch (1951) found that it continued

afterwards, but at a reduced rate. Barrow and White (1952) found it decreased after the age of 14. Woods (1950) found the mandibular intercanine distance remained more or less constant from 3–5 years of age, but decreased from 6–9 years of age. The great individual variation in these measurements was stressed by Lewis and Lehman (1929), Cohen (1940), Burson (1952), and Moorrees (1959).

With regard to the relationship between spacing of the deciduous incisors and alinement of the permanent incisors, there is less agreement.

Delabarre (1819), Colyer (1920), Baume (1950), Clinch (1951), and Barrow and White (1952) observed that if there were no spaces between the deciduous incisors, it was likely there would be irregularities of the permanent incisors. (Clinch classed such deciduous dentitions as malocclusions.) Neumann (1955) noted that the transition from deciduous to permanent incisors took place in a more regular manner in children with spacing of the deciduous incisors than in those without spacing. The presence of spacing was *mostly* followed by satisfactory alinement of the permanent incisors. He was careful to point out that exceptions to these generalizations were noted. Lewis and Lehman (1929), on the other hand, stated that spacing of the deciduous incisors had little relation to the alinement of the permanent incisors.

Korkhaus (1932) found that spaces between the deciduous incisors did not appear in all children with normal maxillary development —the permanent incisors were *comparatively* often well alined when these spaces were missing. He believed that the presence of spacing indicated a marked difference between the mediodistal crown breadths of the deciduous/permanent incisors.

In this series of models, measurements were taken of the intercanine width, upper and lower, on each model (from mid-cervicolingual aspect), and also the distance between the first deciduous molars, upper and lower, from the mid-cervicolingual points. It is seen that though there may be a slight increase of the intercanine width, both upper and lower (0·5–1 mm.), before the shedding of the deciduous incisors, in the majority of the cases the greatest increase (1·5–3·5 mm.) takes place just prior to and during the eruption of the permanent incisors. This confirms the conclusions of others, as stated earlier.

In 11 cases (23·4 per cent), however, measurements showed a decrease at some stage in the intercanine widths. In 2 of these cases the decrease occurred in the deciduous dentition, near the time of replacement of the incisors. In 1 there was a decrease of 1 mm. in the lower intercanine width, and in the other a decrease of 0·5 mm. in the upper intercanine width. In this latter case there was narrowness of the upper arch and a cross-bite, which could account for the noted decrease. In both cases there was an increase in the measurements during the (time of) eruption of the permanent incisors. In the other 9 cases the decrease took place after the permanent lateral incisors had erupted, and following an increase of 1–2·5 mm. during the eruption of these teeth. The decreases ranged from 0·5–1·5 mm. In 6 of the cases it occurred in the upper arch, 2 in the lower arch, and in 1 both upper and lower. These measurements were found on the last models of the series, i.e., on full eruption of the permanent incisors. Woods (1950) found the intercanine width in the maxilla decreased from 7–12 years and that of the mandible decreased from 6–9 years. As he implies that these decreases were general his results are very different from those noted in this series, or found by the other investigators quoted at the beginning.

Barrow and White (1952) noted that the intercanine distances decreased steadily after 14 years of age, in amounts varying from 0·5–1·5 mm.

With regard to spacing between the deciduous incisors, the deciduous models were divided into 5 groups:—

1. Those with good spacing (1 mm. or over) between all the incisors: (*a*) Upper and lower (U/L); (*b*) Upper only (U); (*c*) Lower only (L).

2. Those with slight spacing between all the incisors: (*a*) U/L; (*b*) U only; (*c*) L only.

3. Those with spacing between some, but not all, incisors: (*a*) U/L; (*b*) U only; (*c*) L only.

4. No spacing between any of the incisors, but even alinement: (*a*) U/L; (*b*) U only; (*c*) L only.

5. Crowding of the incisors: (*a*) U/L; (*b*) U only; (*c*) L only.

Table VI.—Deciduous Dentition with Regard to Spacing between the Incisors, showing Numbers in Each Group

	(*a*)	(*b*)	(*c*)
1.	11 U/L	3 U	2 L
2.	2 U/L	2 U	2 L
3.	11 U/L	10 U	3 L
4.	2 U/L	3 U	5 L
5.	2 U/L	1 U	6 L

Table VII.—Showing how Each Group in the Deciduous Dentition Worked out in the Permanent Dentition

Deciduous Dentition		*Permanent Dentition*
Group A U/L (*a*)	11	2 Group 1 U/L (spaced) 3 Group 2 U/L (even) 6 { Group 1 U (U spaced) Group 2 L (L even)
Group B U/L (*a*)	2	1 Group 1 U/L (spaced) 1 { Group 1 U (spaced) Group 2 L (even)
Group C U/L (*a*)	11	1 Group 1 U/L (spaced) 1 Group 2 U/L (even) 3 { Group 1 U (U spaced) Group 2 L (L even) 2 { Group 1 U (U spaced) Group 3 L (L crowded) 2 { Group 2 U (U even) Group 3 L (L crowded) 1 { Group 3 U (U crowded) Group 2 L (L even) 1 Group 3 U/L (crowded)
Group D U/L	2	2 Group 3 (crowded)
Group E U/L	2	2 Group 3 (crowded)

The models of the permanent teeth were divided into 3 groups:—

1. Those with spacing between the incisors (some or all): (*a*) U/L; (*b*) U only; (*c*) L only.

2. Incisors evenly alined, but no spacing: (*a*) U/L; (*b*) U only; (*c*) L only.

3. Incisors crowded: (*a*) U/L; (*b*) U only; (*c*) L only.

Each case was charted out in this way, so that it was easy to follow them through from the deciduous to the permanent dentitions.

In the deciduous dentition the numbers in each group are as given in *Table VI*.

To simplify the results I shall deal here with those in subdivision (*a*) of each group only (*Table VII*), though each case can be followed through.

If we examine those cases where there is no crowding of either upper or lower permanent incisors (i.e., either even or spaced) and trace from which deciduous group they came, the result is seen in *Table VIII*.

Also, if those cases where there is crowding of both upper and lower permanent incisors are traced back to the deciduous dentition, we have the above results (*Table IX*).

Table VIII.—Tracing Back Three Cases in the Permanent Dentition where there was Crowding of the Upper or Lower Incisors to the Deciduous Dentition

Permanent Dentition	*Deciduous Dentition*
No crowding of upper or lower incisors in 21	11 from A U/L (*a*) 2 from B U/L (*a*) 5 from C U/L (*a*) 1 from { B U C L 1 from { B L C U 1 from { A L D U = 4·76 per cent (5 per cent approx.)

Table IX.—Tracing Back Three Cases in the Permanent Dentition where the Upper and Lower Incisors were Crowded to the Deciduous Dentition

Permanent Dentition	*Deciduous Dentition*
Crowding of upper and lower incisors in 11	1 C U/L = 0·09 per cent 3 { C U E L 2 D U/L 2 { D U E L 2 E U/L 1 { E U D L

From *Table VII* it is seen that in all the cases where there was spacing between *all* the deciduous incisors, upper and lower, the permanent upper and lower incisors were either spaced or evenly alined. There was no case of crowding of the permanent incisors.

From the deciduous dentitions in Group C, where there was spacing between some, but not all, of the deciduous incisors, the alinement of the permanent incisors is seen to be more variable. Of the 11 cases, in 5 the permanent incisors were either spaced or evenly alined, whereas in 6 crowding appeared in either lower or upper arch (1 case both upper and lower).

In Group C also it is interesting to note the greater frequency of crowding in the lower permanent incisors. This was found in 5 lower models, compared with 2 upper ones.

In the 4 cases where there was no spacing at all, or crowding, of both upper and lower deciduous incisors, the upper and lower permanent incisors were short of space.

Examination of *Table VIII* shows that of the 21 cases where the permanent incisors were either spaced or evenly alined, in 20 of these there was some spacing of both upper and lower deciduous incisors. In 1 the lower deciduous incisors were well spaced, but there was no spacing of the upper deciduous incisors.

Table IX shows that of the 11 cases where there was some crowding of the upper and lower permanent incisors, in 7 of these there was no spacing at all of both upper and lower deciduous incisors; in 3 there was crowding of the lower deciduous incisors only with spacing between some of the upper deciduous incisors, and in 1 there was spacing between some, but not all, of the upper and lower deciduous incisors. These figures would indicate that there is a very definite association between spacing of the deciduous incisors and even alinement of the permanent incisors (with or without spacing) (or conversely, between crowding of the permanent incisors and lack of spacing of the deciduous incisors). It must not be overlooked, however, that in 4·76 per cent (5 per cent approximately) of those cases where the upper and lower permanent incisors were in good alinement, there was no spacing at all of the deciduous upper incisors and in 9·1 per cent of the cases of crowding of both upper and lower permanent incisors, there was spacing between some, though not all, of both deciduous upper and lower incisors, and some spacing of the deciduous upper incisors only in 27·3 per cent.

There may also be an irregularity of the permanent incisors due to lack of space, apparent when these teeth erupt, but which is self-corrected at a later stage. In those cases of "late alinement of the permanent incisors" the extra space may be obtained (*a*) by further increase of the intercanine width or (*b*) by increased labial proclination of the permanent incisors, sometimes both (*a*) and (*b*).

There are cases, too, where the "over-all" intercanine width is sufficient to accommodate all the permanent teeth in even alinement, but there is spacing between some of them and overlapping of others. The teeth are not able, of themselves, to make the most of the space available.

Neumann (1955) stated that "the differences in the increments of arch breadth and length can be evaluated only when dental development has progressed further", and these findings would indicate that the same holds good with regard to the final alinement of the incisors.

Acknowledgements.—I would like to acknowledge my indebtedness to Dr. McKeag for his encouragement and advice in this work from the beginning, to Mr. Adams for taking the photographs and helping with the slides, to Miss Clinch for handing over her series of models to me, to my many colleagues who have co-operated in the work by bringing along their children or referring their patients, and to Mrs. McCrea for all her assistance with the typing.

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DISCUSSION

The President thanked Miss Bonnar for another fascinating paper, and commented on the tremendous amount of hard work she had put into it. It seemed to him that they just could not have enough of this series, which was full of information. He then called upon Miss Clinch to open the discussion.

Miss L. M. Clinch: I would like to thank Miss Bonnar for another paper on what is, naturally, to me a subject of great interest. It is most useful to get someone else's point of view about one's own serial models which, no matter how often one has studied them, always seem to provide some details which had not been noted previously; I know them well, but I am well aware that there is much more to be learnt from them. As I read Miss Bonnar's paper three things impressed me: first the infinite variety of paths along which individuals may progress to reach the same goal; secondly, how useless it is to attempt to apply statistical data to individual development which can vary so much; and thirdly, how wise Professor Friel was to give the title of "Ideal" to his description of the development of occlusion. Many paths *may* lead to the same goal, but there is only one which leads there with the minimum of risk of interference *en route*.

I would be very interested if Miss Bonnar could give more details of the arch relationship in the permanent dentition of these series as many of the points she makes depend on whether there is normal, post-normal, or pre-normal relationship of the arches to each other. For instance, under her first heading, "Angular Relationships of the Upper and Lower Permanent Incisors at Various Stages of Development", it is easy to understand that the labial inclination of the upper incisors could well increase if there was a post-normal relationship of the lower to the upper arch. I do not think it is possible to separate the incisor occlusion during development from the molar–premolar occlusion as they depend so much on each other. The soft tissues, particularly the lips, and habits could also cause the inclination of either upper or lower incisors to vary at different stages in the same individual. However, I am sure some of the cases described by Miss Bonnar in which the labial inclination of the permanent incisors increases as the teeth erupt have normal anteroposterior arch relationship, but I would like to know if she has any idea what the percentage is of post-normal or pre-normal mandibular occlusion.

Under Miss Bonnar's second heading where a discrepancy was found between the upper and lower centre lines right through the series, what percentage had had no extractions in either arch? I quite agree that if a first deciduous molar is extracted early (before the eruption of the permanent molars), especially in an unspaced arch, there will almost certainly be a deviation of the midline towards the side of the extraction. By contrast, if a second molar is extracted under the same conditions, the midline may not alter, but the first permanent molar will often erupt in contact with the D, even in the lower arch. Extractions after the eruption of the first permanent molars are much less likely to cause a *permanent* alteration in the midline. I would like to know at what age Miss Bonnar's final models of each series were taken. If it was before the eruption of the permanent canines and second molars I think she would find that the centre line might correct itself later on as her incidence of deviation in her final models is considerably higher than I found at 14 years of age in my series. Miss Bonnar does mention *one* of my series in which the deviation did correct itself in the permanent dentition, but actually after the eruption of the full permanent dentition (except for the third molars). Only 5 had a shift of the centre line; in 4 of these the lower had deviated, resulting in a unilateral post-normal occlusion of the lower to the upper arch.

Miss Bonnar's third heading deals with the connexion between attrition and forward movement of the lower arch in relationship to the upper. Friel states, "attrition and increase in upper canine breadth in the maxillary arch do not mean that the mandibular arch will move forward, there must be the *urge* to do so, but unless attrition occurs this alteration in arch relationship cannot take place". The cusps of the unworn deciduous molars are extremely sharp and the fossæ extremely deep; unless some attrition takes place I cannot understand how their planes will allow alteration in arch relationship. I would have thought that if the alteration takes place through this "urge" of which Friel speaks, the locking of the cusps and fossæ must be released, and this can only be done if there is some wear of the cusps. Has Miss Bonnar noticed if the cusps in the cases where forward movement has taken place without attrition are flatter than usual?

The fourth heading deals with rotations of the incisors. It seems to me that many of these individual variations in the development of good occlusion are due to the fact that the teeth have erupted a little too soon; this could apply to the labial inclination of the incisors. As far as rotations are concerned it has been shown that the lower deciduous incisors are rotated in their crypts. If these teeth erupt before this rotation has corrected itself one sees the typical rotation, mediolingually, of the lower central incisors. However, if there is sufficient space these often move into good alinement. In the same way, the positions of the lower permanent laterals in their crypts is lingual to the line of the arch and this is the position into which they will often erupt—again, given sufficient space, they will usually move forward into the line of the arch. In other words the alinement may take place *before* or *after* eruption, or even more commonly *during* eruption as this is the period of maximum increase in intercanine breadth.

Miss Bonnar's fifth heading deals with the distal tilting of the permanent lateral incisors, which is often seen as they erupt. I certainly agree that no treatment should be advised in these cases. There are many temporary displacements of individual teeth which occur at this early period which may appear to be abnormal, but they invariably correct themselves—such as the spacing of the central incisors which may leave little or no room for the laterals. As the laterals and then the canines erupt the centrals move medially. I would like Miss Bonnar to tell me if she has any of these cases amongst her series.

The sixth heading deals with spacing in the deciduous dentition and the alinement of the permanent incisors. It is interesting to find that in approximately 5 per cent of cases where the upper and lower permanent teeth are in good alinement there was no spacing of the *upper* deciduous incisors. This bears out Friel's theory that there may be root spacing of the upper deciduous incisors which cannot be seen above the gum margin. I think there is no doubt that this root spacing takes place even if the crowns are already spaced, but in the 5 per cent of

cases which show no imbrication of the upper permanent dentition despite lack of spacing between the deciduous incisors there is probably a greater degree of this alveolar growth. I have measured the angle of the labial surface of the upper deciduous centrals to the occlusal plane on serial models and I have found that this angle increases with age, indicating that growth in the alveolar region is taking place and carrying the roots of the deciduous teeth with it although there is no increase in the spacing between the crowns of the teeth. This is obviously one way in which space is made for the permanent incisors.

Miss Bonnar points out that there are many slight differences in the findings of those who have measured alterations in intercanine breadth; this may be due to differences in the points used for this measurement, for instance Moorrees used the tips of the canines—this could well show increases or decreases due to tilting of the teeth and not to increased arch breadth. It must be remembered, too, that most investigators show the average measurement of their series at different stages; it would probably be possible to find an individual case which differed from all their findings.

The trouble with trying to write a paper on serial models is that as no two are alike, one is tempted to give a demonstration on the development in each individual; and I would like to congratulate Miss Bonnar on showing many of these small, and often temporary, variations.

The Secretary (Mr. B. C. Leighton) congratulated Miss Bonnar on a very useful contribution to the knowledge of changes that might be expected to take place spontaneously at that time of life. He thought one of the most important points that Miss Bonnar had established was that the labial lingual inclination of the permanent incisors began to be adjusted before those teeth came into contact.

He thought it had been generally recognized that occlusal contact and guidance determined the medial distal relationship of posterior teeth much more than the labial lingual relationship, and the latter were much more at the mercy of muscular influences than of cuspal guidance.

Several questions came to his mind. Miss Bonnar had made no mention of arch relationship or of skeletal morphology. Presumably, those did have some influence on the final inclination of the incisors.

The other question that immediately came to mind was the question of muscular environment. Were the labial or lingual changes in inclination associated with a particular type of muscular behaviour? It might be interesting to speculate whether the more labial inclination occurring in the majority of cases could be associated with the lingual position that these teeth adopted or were found in before they erupted.

He asked Miss Bonnar how she differentiated the deviations within the lower arch from deviations of the mandible on closure towards one side. He had the impression that the latter was quite a common phenomenon; that cuspal guidance in the molar region might carry the mandible slightly to one side, producing a slight post-normality on that side.

There seemed to be some marked discrepancy between the Belfast and the London models in that respect. Could this be due to a different sort of selection between the two groups of models, and, if not, could any significance be attached to it?

Another question he wanted to ask Miss Bonnar was whether the attrition was assessed by examination of the molars or of the incisors, or both? He thought this was rather important, especially in view of what Miss Clinch had just said on the subject. He felt that molar attrition might have been associated with an uncomfortable occlusion, perhaps slight cusp-to-cusp occlusion, and that, in those cases, attrition seemed to be more common.

He congratulated Miss Bonnar once again on the amount of work put into the paper. He knew how difficult these cases were. He was afraid he could not comment really intelligently on it, because the patients in his group were not quite so old as Miss Bonnar's.

Miss Bonnar said she had dealt with occlusion in the previous paper and had not wanted to repeat herself too much on this occasion. On the whole, the majority of the cases were normal, or potentially normal, but the various abnormalities of the teeth did occur in some, as would be expected, and also there were some cases of post-normal and pre-normal occlusions.

When considering the angular relationships of the upper and lower permanent incisors, if there was any habit or any abnormal muscle pattern, these cases were not included, only the ones where the environment was normal, as far as she could judge. That was not to say there might not have been any abnormal muscle patterns, but they were not detectable.

When there was a change of direction of eruption of the upper permanent incisors, both Miss Clinch and Mr. Leighton asked about occlusion. The majority of the cases were normal occlusions, there were a few cases of post-normal occlusion, but only one case of pre-normal occlusion. One of the cases shown on the screen had been post-normal, all the others were normal occlusions.

When considering discrepancy of the centres, if there had been any deciduous or permanent teeth extracted in either arch, this would affect the position of the centres as she had indicated, and these cases were not included. In this group, all the teeth were present, and yet the upper and lower centres did not correspond.

She thought that probably the age of her final cases was not as old as Miss Clinch's. In most of the final models, all the permanent teeth had erupted (except the third molars), but, in some, the deciduous canines were still present. To begin with, she had aimed at recording until the permanent incisors had all erupted, but many had continued longer. Miss Clinch had mentioned that there was not such a discrepancy of the centres in her own later models as in the earlier ones. She was surprised to hear that.

As seen from the slides and the tables, up to the time of the change-over of the incisors and deciduous molars, the discrepancy of the centres remained in all the Belfast models, and all but one of the London models, and she did not expect to find much change after that.

Attrition and forward movement—she had, in discussing attrition, included attrition both of the molars and of the incisors and canines. She had not found many cases where the cusps of the deciduous molars were very sharp. That might be a difference between the Irish and London patients; she did not know. In some cases where they were quite sharp, it did not seem to be a deterrent to the lower arch moving forward. One could see the attrition of the deciduous canines best and that was why she concentrated on showing them on the slides.

As Professor Friel pointed out, the chief factor in the lower arch moving forward was the urge to move forward, and if the urge was there, the lower can move forward, even if the sharp cusps are not worn down.

Rotation of the permanent incisors—she did not find that the age at which the incisors erupted made any difference. The chief point about rotations was that spacing was more often associated with rotation of the permanent upper incisors than crowding, and if there was spacing in the upper arch, one was less likely to get self-correction, whole or partial, of the rotations, than if there was crowding. Spacing in the upper arch was not a favourable factor, but this did not apply to rotated permanent lower incisors.

[Miss Bonnar agreed with Miss Clinch that the spacing of the permanent central incisors, often found when these teeth erupted, closed as the permanent laterals erupted, and often disappeared altogether when the permanent canines erupted.

She had not mentioned these cases because she thought this was generally accepted, but thought there would be some of them in her series.]

Regarding the differences in the measurements of the growth changes taking place in the dental arches, she knew that a few of the investigators used different points for the measurements, but taking this into consideration, there was still too big a variation in the results.

Regarding Mr. Leighton's point about muscular environment, she had answered that by saying there were no abnormal muscle patterns in the cases in these different groups. Where any abnormality was present, that case was not included.

Where there was a deviation of the lower centre, she had been careful to check the movements of the mandible, and only those cases where there was normal opening and closing were considered. There were no abnormalities of the temporomandibular joint to be found.

Mr. Leighton's other point about attrition had also been answered. Attrition of the molars was considered, besides that of the incisors. The amount of attrition taking place in either of these areas was not always of the same degree, though in normal cases, where it was considerable in one area, it was always present to some extent in the other.

The President thanked Miss Bonnar for a most enjoyable paper. It was very nice having her with them again. He hoped it would not be long before she came back with a third instalment. He had heard rumours that there was one on the way.

He also thanked Miss Clinch for opening the discussion, and all those who had taken part in it.

Base-forming Materials for Restorations of Silver Amalgam

To eliminate thermal shock to the pulp, zinc phosphate cement, because of its insulating and compressive properties, is the usual material of choice to place beneath metallic restorations, and this in spite of histological evidence of pulpal damage in some cases. Considerable packing pressure for the condensation of amalgam is desirable and zinc phosphate cement ultimately has a crushing strength of 13,000 lb. per sq. in. But the interval between the placing of the cement in the cavity and the beginning of amalgam condensation is about 3 min., and after that length of time the cement probably has a crushing strength of about only 3000 lb. per sq. in. These condensation pressures are not necessarily all transferred as such to the base-forming material. But in view of the pulpal irritation from zinc phosphate cement, use of a modified zinc-oxide-eugenol combination is suggested with delay of amalgam condensation until a subsequent appointment. Such a combination with an ultimate crushing strength of 5500 lb. per sq. in. is zinc oxide with rosin and zinc acetate and eugenol with olive oil. S.S. White temporary filling material has a strength of 3000 and zinc oxide and eugenol 2000.—Lyell, J. S. (1960), *Aust. dent. J.*, **5**, 132.

G. E. B. Moore

Gencive et Secretion Ovarienne

An attempt was made to correlate ovarian function to the state of the gingivæ with regard to vascular interchange. The method of investigation was to note the gingival temperature with an electrical thermometer, then to reduce the temperature by means of running water at 18° C. for a period of 10 sec. The time taken to regain the original temperature was then noted. In all patients the attached gingivæ between the mandibular central incisors was used.

It was found that:—

1. Cancerous patients treated with Testoviron regained the initial temperature more rapidly than those not receiving the hormone.

2. Patients with a temperature of 36° C. or greater had a shorter recovery time than those with a temperature below 34° C.

3. Women having an erythrocyte count between 3·5–4 thousand recovered more rapidly than those having a count exceeding 4·5 thousand.

4. Patients with hormonal abnormalities recovered more quickly than those who were normal.

It is concluded that without doubt ovarian function exerts an influence on the capillary circulation of the gingivæ.—Bethmann, W. (1959), *L'Information Dentaire*, **36**, 908.

B. Wade